



STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION



July 9, 2007

RCRA RECORDS CENTER
FACILITY Arch Chemicals
I.D. NO. CTD 980 916 779
FILE LOC. R-9
OTHER *106089



RDMS DocID

106089

Ray Cody
USEPA
Corrective Action Section- HBT
Office of Site Restoration and Remediation
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Hi Ray,

Here is the info on Arch Chemicals, Inc. They have completed site clean-up under the property transfer program. They have completed RCRA closure and have been released from financial. They submitted a QAPP that I have reviewed and am satisfied with and they have conducted a well survey. They would like to have interim status terminated. Hopefully we can get them out of the system.

Environmental indicators have not been done. The four things I am sending you for the EIs are:

- The September 28, 2005 letter from DEP releasing them from financial assurance for closure of the container storage area.
- Documentation related to the audit for their verification.
- The Verification report dated March 2004
- Ecological Risk Assessment Work Plan dated April 2007

If you need any other information let me know.

Thanks,



STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION



September 28, 2005

Mr. William Mitchell
Manager of Regulatory Issues
Arch Chemicals, Inc
1200 Lower River Road NW
P.O. Box 800
Charlestown, TN 37310

SITE NAME: Arch Chemicals
TOWN: Cheshire
FILE TYPE: PER
logged in ecrasys 9/30/05 dwd

Re: Closure Plan Approval and Financial Assurance Release; Container Storage Area, Arch Chemicals, Inc. 350 Knotter Drive, Cheshire, CT
EPA ID. No. CTD980916779

Dear Ms. Snyder:

The Connecticut Department of Environmental Protection (CTDEP) has reviewed and approves the "Closure Plan - Volume 1 Work Plan" dated October 1999 prepared by HRP Associates, Inc. and the "RCRA Closure Plan Part 2, Part 3 and the RCRA Closure Certification Report" dated May 2005 prepared by ENSR International for the hazardous waste container storage area known as the Interim Waste Storage (IWS) unit located at Arch Chemicals, Inc. (Arch), 350 Knotter Drive, Cheshire, Connecticut. This Resource Conservation Recovery Act (RCRA) closure was public noticed in the Hartford Courant on August 3, 2005. There were no comments from the public.

This closure certification information satisfactorily documents to the CTDEP that Arch has closed its interim waste storage unit in accordance with the Closure Plan approved above. These plans meet the requirements of Section 22a-449(c)-105 of the Connecticut Hazardous Waste Management Regulations, (CT HWMR), and 40 CFR Part 265 Subpart G of the Code of Federal Regulations.

Therefore, Arch is no longer required to maintain financial assurance for closure of this unit as required in Section 22a-449(c)-105 of the CT HWMR and 40 CFR 265.143(h). Likewise, in accordance with Section 22a-449(c)-105 of the CT HWMR and 40 CFR 265.147(e), Arch is no longer required to maintain liability coverage for its former hazardous waste container storage area.

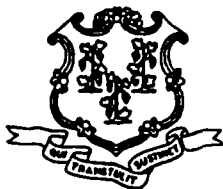
If you have any questions concerning this letter, please call Sandra Brunelli of my staff at (860) 424-3300.

Sincerely,

Elsie Patton

Elsie Patton
Director
Waste Planning and Standards Division
Waste Bureau

c: Mark Latham - CTDEP
Michelle Snyder Project Specialist, ENSR Westford, 2 Technology Park Drive, Westford, MA 01886



STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
AUDIT FINDINGS



August 16, 2004

Dan Bennewitz
Arch Chemicals, Inc.
P.O. Box 800
Charleston, TN 37310

RE: **Verification Audit**
Arch Chemicals
350 Knotter Drive, Cheshire, Connecticut

Dear Mr. Bennewitz:

This letter is to notify you of the Final Audit Findings of the verification rendered by Lawrence M. Hogan LEP, license #151 on March 30, 2004. The verification was submitted to the Department of Environmental Protection (the Department) in conjunction with the July 17, 2000 Form III filed with the DEP pursuant to §22a-134a(c) of the CGS.

Based on the review of all available information, the Department finds that the verification rendered by Lawrence M. Hogan is hereby acceptable.

On May 25, 2004, the Department notified you that pursuant to CGS Section 22a-133v(g), the Commissioner was conducting an audit of the investigation performed as a basis for the above referenced verification.

On June 2, 2004 a conference was convened with Lawrence M. Hogan by telephone. The purpose of the conference was to provide Lawrence M. Hogan an opportunity to discuss his verification in the context of the issues of concern identified by the Department during the audit process, and to present any additional information which would demonstrate that the above referenced parcel was investigated in accordance with prevailing standards and guidelines, and that compliance with the RSRs had been achieved.

Upon review of all technical data and the additional information discussed during the conference, the initial issues of concern regarding the validity of the verification were addressed.

If you have any questions or comments, please contact Raymond Frigon, Jr. of my staff at (860) 424-3797.

Sincerely,

Elsie Patton

Elsie Patton
Acting Director
Planning and Standards Division
Waste Management Bureau

c: Lawrence M. Hogan, ENSR International
Kim Maiorano, DEP
Robert Robinson, DEP
Sent Certified Mail
Return Receipt Requested

(Printed on Recycled Paper)
79 Elm Street • Hartford, CT 06106 - 5127

<http://dep.state.ct.us>

An Equal Opportunity Employer

From: Raymond Frigon
To: Elsie Patton
Date: 9/16/04 2:42PM
Subject: Arch Chemicals, Cheshire - Audit findings

Elsie, we performed an audit of the verification rendered by Larry Hogan for the above site. The primary reason for the audit was that the Commissioner's approval for additional polluting substances was requested for several compounds (which included acetonitrile, acrolein, aniline, 2-chlorophenol, 2,4-dichlorophenol, pentachlorobenzene, pyridine, and 1,2,4,5-tetrachlorobenzene) "identified at the site", after the verification was rendered.

Larry and I had a phone conversation about the audit of his verification. During that conversation it was revealed that the additional polluting substances were never actually "identified" in environmental media from the site.

One area of concern on-site, an interim waste storage area, was being closed under RCRA simultaneous to the LEP verification process. Based on the use of the subject AOC, EPA specified Media Closure Criteria, requiring the investigation to include analysis for specific compounds by default. Testing was performed at the AOC for the specified compounds and none were detected - nor were any other substances. So, there was never actually a "release" at the AOC. Approval of criteria for additional polluting substances was requested from DEP for the compounds listed above only to support the RCRA closure of the AOC.

The RSRs require approval of additional polluting substances at a "release area".

CC: Rob Robinson

2 Technology Park Drive
Westford, Massachusetts 01886
Telephone (978) 589 3000 Fax (978) 589 3035



St. ID# 1279
Per # 1156
Ver # 82

LETTER OF TRANSMITTAL

TO: Mr. Ray Frigon
CT DEP- PERD
79 Elm Street
Hartford, Connecticut 06106-5127

**REMEDICATION SECTION, 2ND FL
RECEIVED**

APR 05 2004

FROM: Larry Hogan

WASTE MANAGEMENT BUREAU

DATE: March 30, 2004

SUBJECT: Verification Report, Arch Chemicals Facility 350 Knotter Drive, Cheshire,
Connecticut

No. of Copies: 1
For your approval
For your review
As requested

For your action
Return to me
For your use X

Dear Mr. Frigon:

Enclosed please find a Verification Report for the property located at 350 Knotter Drive in Cheshire Connecticut. Investigation of the property has been performed under Licensed Environmental Professional (LEP) direction and in ENSR's opinion, compliance with Transfer Act Site Assessment Guidance and the Remediation Standard Regulation has been demonstrated. Please call me at (978) 589-3131 with any questions.

Sincerely,

ENSR


Lawrence M. Hogan, PG, LSP, LEP
Project Manager

cc: William Mitchell / Arch
John Lesky/Arch

6.0 VERIFICATION STATEMENT

Based on the above, it is ENSR's opinion that the investigations conducted by Arch Chemical pursuant to CGS 22a-134a have been effective in demonstrating compliance with R.C.S.A. 22a-133k-1 to -3. Furthermore, it is ENSR's opinion that the investigation and remediation of the site has been conducted in accordance with the standard of care provided for in CGS 22a-133V (c). Therefore, in accordance with the Connecticut Transfer Act, Connecticut General Statutes Title 22a Section 22a-134 (19) and Regulations of Connecticut State Agencies 22a-133v-1(z), I am verifying that site work related to the Arch Chemical Form III filing in May 22, 2000 and July 21, 2000 facility is complete.

VERIFICATION


Lawrence M. Hogan, LEP License No. 151

3/30/04
Date



LEP Seal



STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION



May 25, 2004

Lawrence M. Hogan
License # 151
ENSR International
2 Technology Park Drive
Westford, MA 01886

RE: Verification of Investigation and Remediation
Arch Chemicals
350 Knotter Drive, Cheshire, Connecticut

NOTICE OF AUDIT

On March 30, 2004, you rendered a verification under §22a-134a(g) of the Connecticut General Statutes (CGS) for an establishment located at 350 Knotter Drive, in Cheshire, known as Arch Chemicals, and more fully described in the Cheshire Tax Assessor's Office as lot 13, on map 9. The verification was submitted to the Department of Environmental Protection on April 5, 2004 in conjunction with the July 17, 2000 Form III filed with the DEP pursuant to §22a-134a(c) of the CGS.

Your verification is a written opinion that an investigation has been performed at the parcel in accordance with prevailing standards and guidelines, and that the establishment has been remediated in accordance with the Connecticut Remediation Standard Regulations, 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.

This letter is to notify you that pursuant to Section 22a-133v(g), the Commissioner is conducting an audit of the investigation performed as the basis for the above referenced verification.

Please contact us to schedule a meeting to discuss our initial review of the above referenced verification. At that time, you may introduce your conceptual site model and additional information related to the investigation of the parcel and remediation of the establishment supporting your verification that remediation of the establishment has been completed in accordance with the Remediation Standard Regulations.

Please reference the attached memo for potential issues of concern regarding your verification. You may contact Raymond Frigon, Jr. of my staff at (860) 424-3797 to answer any questions, and to schedule the meeting.

Sincerely,

Thomas W. RisCassi, Supervisor
Remediation Section, Southcentral District
Waste Management Bureau

c: Dan Bennewitz, Arch Chemicals, Inc.
Robert Robinson, DEP

Sent Certified Mail

MEMO

AUDIT RECOMMENDATION

To: Thomas RisCassi, Supervisor 11/28 5/18
Remediation Section/South Central District

Robert Robinson, EA III
Audit Program Coordinator

RE: LEP Verification by:
Lawrence Hogan
ENSR International
Verification: March 30, 2004

From: Ray Frigon, EA III
Remediation Section/South Central District

ESTABLISHMENT
Arch Chemicals, Inc.
350 Knotter Drive
Cheshire

Date: May 18, 2004

This memo presents an initial review of the Form III Final verification rendered by Lawrence Hogan for the above referenced parcel.

Groundwater Classification	GB
----------------------------	----

Drainage Basin #	5202-00
------------------	---------

SITE DESCRIPTION

The site is located in the Cheshire Industrial Park, surrounded by commercial/industrial properties and comprises approximately 75 acres, of which 30 acres are wetlands, ponds, and wooded areas.

Prior to site development the site was used for agricultural purposes. The site was developed in 1975 and occupied until 1983 by Siemens, a manufacturer of medical equipment. Olin Corporation occupied the site from 1983 to 1999, followed by Arch Chemicals, Inc. from 1999 to present. Both companies conducted research and development of swimming pool chemicals, liquid toners, propellant for explosives, urethane compounds, and biocide compounds.

PROPERTY TRANSFER HISTORY

On July 21, 2000, the Department received a Form III filing for the site pursuant to the Property Transfer Act. On August 15, 2000, the Department notified the Certifying Party, Arch Chemicals, Inc., that a Licensed Environmental Professional may verify the site investigation and remediation.

Page 2

Audit Recommendation Memo

RE: Arch Chemicals, Inc., 350 Knotter Drive, Cheshire

Based on the information presented in support of the verification, the following issues have been identified as potential concerns:

I. NON-COMPLIANCE WITH THE RSR'S

Section 22a-133k-2(b)(4) of the RCSA state: "With respect to a substance at a release area for which a direct exposure criterion is not specified in sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, the Commissioner may, after consultation with the Commissioner of Public Health, approve in writing a direct exposure criterion to apply to such substance at a particular release area."

During RCRA closure of an Interim Waste Storage Unit on-site, the following compounds were detected: acetonitrile; acrolein; aniline; 2-chlorophenol; 2,4-dichlorophenol; pentachloronitrobenzene; pyridine; and 1,2,4,5-tetrachlorobenzene. The Remediation Standard Regulations do not specify specific criteria for these compounds.

In a letter to the Department dated March 9, 2004, the LEP submitted calculations to support additional criteria for the additional polluting substances detected at the Interim Waste Storage Unit. A letter from the Department dated April 16, 2004, requests additional information regarding the calculations. The proposed additional criteria are still under review by the Department, in conjunction with the Department of Public Health.

In summary, the reported data do not appear to support Lawrence Hogan's verification that the parcel has been investigated in accordance with prevailing standards and guidelines, and that the establishment has been remediated in accordance with Remediation Standard Regulations.

I recommend a formal audit of the verification rendered by Lawrence Hogan, license #151.

REMEDATION SECTION, 2ND FL
RECEIVED

APR 05 2004

WASTE MANAGEMENT BUREAU

**Arch Chemicals, Inc.
350 Knotter Drive
Cheshire, Connecticut**

Verification Report

Prepared For:



1200 Lower River Road
Charleston, Tennessee 37310

Prepared by:



2 Technology Park Drive
Westford, Massachusetts 01886

**March 2004
Document Number 00489-004**

2 Technology Park Drive
Westford, Massachusetts 01886
Telephone (978) 589 3000 Fax (978) 589 3035



LETTER OF TRANSMITTAL

TO: Mr. Ray Frigon
CT DEP- PERD
79 Elm Street
Hartford, Connecticut 06106-5127

REMEDATION SECTION, 2ND FL
RECEIVED

APR 05 2004

FROM: Larry Hogan

WASTE MANAGEMENT BUREAU

DATE: March 30, 2004

SUBJECT: Verification Report, Arch Chemicals Facility 350 Knotter Drive, Cheshire,
Connecticut

No. of Copies: 1
For your approval
For your review
As requested

For your action
Return to me
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Dear Mr. Frigon:

Enclosed please find a Verification Report for the property located at 350 Knotter Drive in Cheshire Connecticut. Investigation of the property has been performed under Licensed Environmental Professional (LEP) direction and in ENSR's opinion, compliance with Transfer Act Site Assessment Guidance and the Remediation Standard Regulation has been demonstrated. Please call me at (978) 589-3131 with any questions.

Sincerely,

ENSR

Lawrence M. Hogan, PG, LSP, LEP
Project Manager

cc: William Mitchell / Arch
John Lesky/Arch

BUREAU WATER MANAGEMENT
SITE NAME Arch Chemicals
ADDRESS 350 Knotter Dr.
TOWN Cheshire
FILE TYPE Remediation

CONTENTS

<u>SECTION</u>	<u>PAGE</u>
TABLES	iii
FIGURES	iii
1.0 INTRODUCTION	1
2.0 SITE DESCRIPTION	3
2.1 Physical Setting	3
2.2 Potential Receptors	4
2.3 Site Operations	4
2.4 Site History	6
2.5 Applicable Remediation Standard Regulation and Other Criteria	7
3.0 SUMMARY OF SITE INVESTIGATIONS	9
3.1 GZA, Phase I and Phase II Environmental Site Assessment, November 1999	9
3.2 ENSR, Phase III Transfer Act Site Assessment, July 2001	11
3.3 ENSR, Quarterly Groundwater Monitoring Reports, July 2001, November 2001,	12
and February 2002	12
3.4 ENSR, Additional Subsurface Investigation of the Former Interim Waste	14
Storage Unit, February 2002	14
3.5 HRP Associates, Inc., RCRA Closure of Former <90 Day Hazardous Waste	15
Container Storage Area, May 15, 2002	15
3.6 ENSR, Limited Dieldrin Investigation near the Former Interim Waste Storage	16
Unit, December 2003	16
4.0 PRESENTATION OF SITE DATA AND DEMONSTRATION OF COMPLIANCE	17
4.1 AOC Source Evaluation Sampling	18
4.1.1 Former Interim Waste Storage Unit Sampling	18
4.1.2 Former Swimming Pool Chemical Testing Area Sampling	20
4.1.3 Former Treatment Pit and Test Well Sampling	20
4.1.4 Septic Tank Sampling	20
4.2 PAOC Sampling	21
4.2.1 Former Less Than 90-day Waste Storage Room and Virgin Chemical Storage	21
4.2.2 20,000-Gallon Fuel Oil UST	23
4.2.3 Non-Contact Cooling Water and Chiller Condensate Discharge	23
5.0 CONCEPTUAL SITE MODEL	25
6.0 VERIFICATION STATEMENT	27
VERIFICATION	27

TABLES

Table 1 Summary of Soil Analytical Results

Table 2 Summary of Groundwater Analytical Results

FIGURES

Figure 1 Site Locus

Figure 2 Site Plan

Figure 3 Groundwater Contour Map, February 7, 2002

APPENDICES

Appendix A - LEP-Lead Schedule Letter

Appendix B - ENSR, Limited Dieldrin Investigation near the Former Interim Waste
Storage Unit, December 2003

Appendix C – CTDEP Approval Letter for Use of Draft RVC

1.0 INTRODUCTION

This Verification Report was prepared by ENSR International (ENSR) on behalf of Arch Chemicals, Inc. (Arch) for the facility located at 350 Knotter Drive in Cheshire, Connecticut (the "site"). The work documented herein was performed in accordance with ENSR's July 3, 2003 proposal to Arch and ENSR's General Conditions and Commercial Terms. This report, which represents a summary of site assessment activities conducted at the site, includes a description of the site (Section 2.0), a summary of environmental investigations conducted at the site (Section 3.0), a discussion of Transfer Act compliance (Section 4.0), and an update of the Conceptual Site Model (CSM) (Section 5.0). Note that the CSM was originally presented in ENSR's January 2001 Phase III Work Plan and was updated in the July 2001 Phase III Report. The facility is subject to the Transfer Act (Connecticut General Statutes [CGS] 22a-134 and 22a-134a to -134e inclusive) due to the fact greater than 100 kilograms in any one month of hazardous waste was generated on-site subsequent to November 19, 1980.

Arch was created in February 1999 as a separate entity comprising the former pool chemicals division of Olin Chemicals, Inc. (Olin). Accordingly, Arch and Olin filed Transfer Act forms with the CT DEP upon the creation of Arch, a transaction which qualified as a property transfer under the Transfer Act. In February 1999, Arch filed a Transfer Act Form I with the CT DEP indicating that there had not been a release of hazardous waste at the site. The Form I was filed on the basis that Olin and Arch had no record of a release of hazardous waste and the prior owner Siemens existed prior to the "look back" date of the Transfer Act. CT DEP rejected the Form I on the basis of insufficient site investigation. Arch and Olin subsequently filed a Form III with an Environmental Condition Assessment Form (ECAF) with the CT DEP on May 22, 2000. A second Form III and ECAF filing was required on July 21, 2000 as a result of the sale of the facility property to Winstanley Enterprises (Winstanley). Winstanley presently leases a portion of the facility back to Arch and the balance of the facility to another tenant, Alexion Pharmaceuticals, Inc (Alexion). Alexion is a biopharmaceutical company committed to developing a novel class of anti-inflammatory compounds, known as complement inhibitors. Figure 2 depicts the portions of the facility currently occupied by Arch and that occupied by Alexion. Arch was listed as the "certifying party" on both Form III filings indicating that it will undertake the investigation and remediation of the site in accordance with prevailing standards and guidelines. Currently, in order to achieve closure, sites must comply with the Connecticut Remediation Standard Regulation (RSR) and the Transfer Act Site Assessment Guidance (TASA) Document. The last version of the TASA guidance document was issued in 1991, however a draft update was issued in June 2000.

The CT DEP issued two letters in response to the two Form III filings; one dated July 31, 2000, and one dated August 15, 2000, indicating that the investigation and remediation

of the site may be verified by a LEP. On behalf of Arch, ENSR filed a schedule in response to the CT DEP letters on September 5, 2000 as required by Section 22a-134a(h) of the Transfer Act. The schedule responds to both Form III filings and specified that investigation of the site would be completed by August 5, 2002, two years after the date the first LEP-lead letter was received from CT DEP. The investigation was complete by August 2002 and four consecutive quarters of monitoring were completed by February 2002; however, site closure was delayed due to the development and approval of additional criteria for compounds of concern (COCs) that did not have RSR criteria. In addition, a Resource Conservation and Recovery Act (RCRA) Closure Assessment was to be performed for the former interim >90-day hazardous waste storage (IWS) unit and the Phase III Work Plan assumed data from that assessment would be used to evaluate that AOC. In addition to site work performed by ENSR, Phase I and Phase II Site Investigations were performed by GZA Geoenvironmental (GZA) on behalf of Winstanley. These reports were provided to ENSR and data from them were used to develop ENSR's Phase III Investigations. Approval to use proposed RSR criteria was received by Arch on April 10, 2003. Consequently, compliance with available RSR criteria has now been demonstrated and this submittal represents verification that the site investigation has been completed in accordance with prevailing standards and guidelines and that compliance with the RSRs has been achieved. A copy of the LEP-lead schedule letter is included as Appendix A.

The following documents have been previously submitted to CTDEP, and have been used to support, along with the additional investigations described here-in, the verification of site compliance with prevailing guidelines and RSR criteria. These reports are incorporated into this verification report by reference (also see Section 7.0, References).

- GZA, Phase I and Phase II Environmental Site Assessment, November 1999
- ENSR, Phase III Transfer Act Site Assessment, July 2001
- ENSR, Quarterly Groundwater Monitoring Reports, July 2001, November 2001, and February 2002
- ENSR, Additional Subsurface Investigation of the Former Interim Waste Storage Unit, February 2002
- HRP Associates, Inc., RCRA Closure of Former <90 Day Hazardous Waste Container Storage Area, May 15, 2002
- ENSR, Limited Dieldrin Investigation near the Former Interim Waste Storage Unit, December 2003

2.0 SITE DESCRIPTION

The Arch facility is located in the Cheshire Industrial Park in Cheshire, Connecticut (Refer to Figure 1, Site Locus). The facility is surrounded by industrial/commercial properties including Louis Deberadinis/Allied Signal Aerospace Company, FIP Realty Corporation, Federated Corporate Services, and United Technologies Corporation. The subject site encompasses approximately 75 acres and is occupied by a 144,700 square foot building. The majority of the building is one story in height with small two story sections and is constructed of concrete block on a slab foundation. The site is located in an area where groundwater is classified by the Connecticut Department of Environmental Protection (CT DEP) as "GB", indicating that it is considered degraded and is not suitable for human consumption without treatment. Pertinent site features are illustrated on Figure 2, Site Plan. Approximately 30 acres of the site are occupied by undeveloped wetlands, ponds, and wooded areas. The balance of the property is landscaped. The facility is serviced by public water, sanitary sewer, electric and natural gas utilities. The facility boilers are fueled by both fuel oil and natural gas. One 20,000-gallon underground storage tank (UST) containing #2 fuel oil is located east of the site building, near the boiler room. This fuel oil UST was installed in 1993 as a replacement for a similarly sized tank that was installed in 1975.

2.1 Physical Setting

The site is set in a valley area at an elevation of approximately 150 feet above mean sea level (refer to Figure 1). Subsurface investigations have demonstrated that the site is underlain by interbedded fine sand, silt and clay which in turn underlain by silt and clay at a depth of approximately 10 to 14 feet.

These observations are consistent with the regional Surficial Geologic Materials Map of Connecticut that describes the surface deposits beneath the site as:

- Composed of well sorted thin layers of alternating silt and clay or thicker layers of very fine sand and silt. Very fine sand commonly occurs at the surface and grades downward into rhythmically bedded silt and clay varves (lake-bottom deposits) (Stone et, al 1992).

The bedrock beneath the site is mapped as the New Haven Arkose. Bedrock refusal was not encountered on site, nor have any bedrock outcrops been identified on the site.

2.2 Potential Receptor Survey

As mentioned above, the site is located in an area that is mapped as GB. The surficial geology on-site is consistent with this designation as the water yielding properties of the deposits observed and mapped are poor. Nevertheless, ENSR contacted the Chesprocott Health District (Serving the towns of Cheshire, Prospect and Wolcott, Connecticut) to ascertain whether there was any known use of water within the site area. Based on the information provided, there are no documented uses of groundwater within the vicinity of the site.

2.3 Site Operations and Updated Site Inspection

Arch/Olin has used the facility as a research and development (R&D) laboratory facility throughout their occupation of the site. On July 25, 2003, ENSR visited the site to inspect the facility and to confirm that site operations had not significantly changed. R&D work conducted by Arch/Olin concentrated on swimming pool chemicals, surfactants, liquid toners, urethane compounds, and biocide compounds. Project-specific specialty chemicals (e.g. propellants for explosives) have also been the subjects of R&D at the facility.

Wastewater from the R&D laboratories operated by both Arch and Alexion is discharged to the sanitary sewer via separate discharge lines. The Arch R&D laboratory operation discharges their wastewater under CTDEP's "General Permit for Miscellaneous Discharges of Sewer Compatible (MISC) Wastewater." According to Alexion's Director of Operations and Engineering, Mr. Dan Caron, Alexion submitted a Letter of Intent to CT DEP, dated July 24, 2000, regarding General Discharge Registration due to the non-existent but pending CT DEP General Discharge Permit (a different General Permit than the MISC General Permit that Arch utilizes). To date, CTDEP Permitting, Enforcement & Remediation Division has yet to draft a General Discharge Permit and as such no formal permit is required; however Alexion does maintain its facility under BMP's (Best Management Practices).

A 10,000-gallon underground diversion tank formerly associated with the lab wastewater discharge is present outside the southeastern side of the building. According to both Arch and Alexion personnel, this tank was disconnected from the sanitary sewer line as part of the facility renovation conducted in 2000 when Arch moved to a smaller portion of the facility and before Alexion moved in. Thus, the diversion tank is no longer subject to the potential for receipt of wastewater. Prior to 2000, in the event of a spill, wastewater could be diverted to the tank to prevent discharge to the sanitary sewer. Arch personnel indicated that there was never a need to use this tank.

Chemical wastes from Arch's on-site R&D laboratories are consolidated into 5 to 55-gallon drums and shipped off-site as hazardous waste. The amount generated by any one lab is small; however, the combined volume of waste produced by the formerly more than eighty on-site R&D laboratories formerly rendered Arch a large quantity generator. Arch formerly operated an interim status >90-day hazardous waste storage unit (IWS unit) located in a small building outside the eastern side of the main building. This unit is no longer in use. In addition, a less than 90-day waste storage room was present in the south side of the site building. This room was constructed such that its entire floor functioned as secondary containment and drip pans were placed beneath all containers. The room also had a drain that led to an outside UST that functioned as tertiary containment. According to Arch personnel, this tertiary containment UST was never used and was removed in 1993. No soil or groundwater samples were reported to have been collected upon removal of this tank. However, the area of the former tertiary containment UST was evaluated as part of Transfer Act investigations as discussed in Section 3.0. A virgin chemical storage room was also located in the southern side of the building. Arch has no record of a spill from this room. The area around the virgin chemical storage room was also evaluated during the Transfer Act investigations described in Section 3.0.

As part of the site redevelopment, a new less than 90-day waste storage area was constructed on the west side of the site building and was used by Arch beginning in January 2001. ENSR inspected this area on July 25, 2003. All wastes currently generated on-site are stored in the new less than 90-day storage area. This entire room is constructed to function as secondary containment. In addition, containment pans are present beneath the drums and containers in the room. An additional secondary containment device used for catching any spills while pouring contents of small containers into larger containers is located in the <90-day storage area. Bulk storage of virgin chemicals is also located in the new less than <90-day storage area. Bench top quantities are used and stored in the laboratories. No staining, cracks or leaks were observed in the <90-day storage area.

A grassy area located to the south of the facility was formerly used as a test area for swimming pool chemicals. The test area consisted of several above ground swimming pools. According to Arch personnel, the pools were used by employees as part of the testing procedure to provide normal biological loading to the water.

GZA reported that chiller condensate and non-contact cooling water were formerly directed to a floor drain in the mechanical room. This drain was believed to be connected to the sanitary sewer system however, it was not. Consequently, from 1984 to 1988, this water was discharged to a drainage ditch located to the southeast of the facility. Approximately 4,000-gallons per day for approximately 150 days per year were

discharged. The water was reported to contain zinc at a concentration of 0.5 mg/L, chlorine, and phosphonate. Floor drains in laboratory areas were sealed when Olin purchased the facility in 1983. GZA evaluated this outfall as part of their Phase II investigations (refer to Section 3.0).

In 2000, Alexion moved its corporate headquarters to the portion of the building vacated by Arch. Part of the Alexion headquarters is used for research and & development (R&D) laboratories. As a result, Alexion maintains status as a conditionally exempt small quantity generator indicating that they generate less than or equal to 100 kg of hazardous waste per month, accumulate no more than 1000 kg on site at any one time and no more than 100kg of waste, soil, debris or residue that contains no more than 1 kg of "acute hazardous waste". Alexion does not conduct manufacturing at the facility. Their pilot manufacturing plant, currently producing pharmaceuticals for clinical trials is located in New Haven, Connecticut. According to Mr. Caron, Alexion waste consists primarily of small quantities of spent organic solvent associated with high-pressure liquid chromatography (HPLC), flammables (alcohols), some toxic compounds and used oil associated with vacuum pump operations. The used oil is not considered a hazardous waste. Alexion's waste storage room is located adjacent to Arch's former <90-day water storage room (refer to Figure 2). Acid and base wastes are neutralized and discharged under BMP to the sanitary sewer.

During their tenancy at the building, Alexion has not had a reportable spill of any virgin or waste chemicals. However, one event occurred in February 2001 when a chemical was noted within the pH adjustment system. During this event, the sump overflowed and a turpentine-like odor was observed. Alexion notified CTDEP; however, sample analysis proved that the material on the water that overflowed the sump was turpentine used in cleaning and the event was not considered a chemical spill because it was contained within the pH adjustment system. In addition, the overflow was confined to the system's secondary containment and nothing was released to the environment.

2.4 Site History

The facility was originally constructed in 1975 and was originally serviced by a private septic system. This system was located to the east of the facility building. An addition was built onto the southwestern portion of the building during 1980 and 1981 and the facility was connected to the municipal sanitary sewer system in 1981. The facility has been used by Arch/Olin since Olin acquired the facility in 1983. The facility was previously occupied by Siemens, a medical equipment manufacturing company, from its construction in 1975 to 1983. No information was available regarding the specific activities performed by Siemens at the facility. Prior to 1975, the site and surrounding area was under agricultural use.

Previous environmental reports for the site (discussed further in Section 3.0) documented the presence of several historical site features of potential environmental significance that were not related to Arch/Olin site use. These include a "test well" and former treatment pits located within the eastern end of the building as well as a leaching pit and a 1,500-gallon UST of unknown use located to the east of the building. These features were never used by Arch/Olin and their function is unknown; however, the 1,500-gallon UST was closed in place by Olin in 1983 after it was emptied and cleaned. The contents of the UST were characterized as an ignitable organic and were consequently disposed of as hazardous waste. The 1,500-gallon UST and the leaching pit were both located in the vicinity of the facility's IWS unit, although they are not associated with it in any way.

2.5 Applicable Remediation Standard Regulation and Other Criteria

The analytical data from this investigation was compared to specific contaminant concentrations listed in the Connecticut Department of Environmental Protection (CT DEP) Remediation Standard Regulations (RSR) 22a-133k-1, et-seq., dated January 30, 1996 and List of Approved Criteria for Additional Polluting Substances dated April 30, 1999. The RSR provides media specific criteria for the remediation of sites where hazardous wastes or other pollutants have been disposed or released to the environment. The remediation goals for contaminated soil are evaluated by two methods:

- Residential and Industrial/Commercial Direct Exposure Criteria (RDEC and ICDEC) – intended to protect human health from risks associated with direct exposure to pollutants in contaminated soils for residential or industrial/commercial exposure scenarios. The RDEC assumes that there are no limitations to future site use. The ICDEC uses an industrial/commercial exposure scenario, requiring an Environmental Land Use Restriction (ELUR) if the ICDEC is met but the RDEC is not.
- GB Pollutant Mobility Criteria (GBPMC) – intended to protect groundwater quality from pollutants with the potential to migrate to groundwater from vadose zone soils. The subject site is located in an area is located in an area with a "GB" groundwater classification, which is defined by CT DEP as an area where groundwater is presumed to be unsuitable for human consumption without prior treatment. Therefore, the GBPMC applies to the site.

Groundwater remediation goals are also outlined in the RSR, and they are in part dependent upon groundwater quality classifications. Since the site is located in a "GB" groundwater classification zone, two standards are present in the RSR which apply to

groundwater beneath the site:

- Surface Water Protection Criteria (SWPC) – intended to protect the quality of a surface water body, wetland area, or intermittent stream to which a groundwater plume discharges.
- Residential and Industrial/Commercial Volatilization Criteria (RVC and ICVC) – intended to protect the occupants of existing or future buildings from the accumulation of VOCs in groundwater at depths of less than fifteen feet below surface grade which could migrate from a groundwater plume to the interior of an existing structure, or the interior of a possible future structure. Like the RDEC, the RVC assumes unlimited future site use, and like the I/C DEC, the ICVC uses an Industrial/Commercial Exposure Scenario and requires the implementation of an ELUR.

In addition to the RSR criteria other regulatory standards were considered. The investigations completed at the site have not identified a mobile plume that could impact surface water therefore, it was not necessary to compare to the Aquatic Life Criteria given in the Connecticut Water Quality Regulations. In addition, since the RSR criteria, are not reporting thresholds, the data was also be compared to thresholds defined in Connecticut Public Act 98-134 (PA 98-134), also codified in Connecticut General Statute 22a-6u. PA 98-134 established notification thresholds for significant environmental hazards. These thresholds are related to multiples of RSR criteria, actual or potential impacts to drinking water wells, or surface water acute toxicity criteria. According to PA 98-134, DEP notification is required at sites where contamination has been detected: in a drinking water well (above or below the GWPC), in excess of the GWPC in groundwater within 500 feet upgradient of a drinking water well, in excess of thirty times the RVC or I/C VC in groundwater beneath a building (depending upon site use), in excess of ten times the acute toxicity criteria for groundwater which discharges to surface water, in excess of thirty times the RDEC or ICDEC (depending upon site use) in soil within two feet of the ground surface, or in vapors in soil or groundwater resulting in an explosion threat. The timing of notification to CT DEP is dependent upon the specific type of environmental hazard identified. No exceedances of thresholds given in CGS 22a-6u were observed in the site investigations used to support this Verification.

3.0 SUMMARY OF SITE INVESTIGATIONS

The following paragraphs summarize all of the site assessment activities that have been conducted at the site to date in response to the initial Transfer Act filings. Note that copies of the reports dated prior to August 2001 are on file with CT DEP with copies attached to the 2001 Annual Report, 2002 Annual Report, or to the ECAF submittals in 2000.

3.1 GZA, Phase I and Phase II Environmental Site Assessment, November 1999

GZA completed site investigations at the property on behalf of Winstanley as part of environmental due diligence investigations conducted prior to their purchase of the facility. GZA installed eleven monitoring wells at the property, submitted five soil samples for analysis, and sampled the wells one or two times, depending upon their installation date. Summary data from the GZA report was included in ENSR's Phase III report, which was submitted to CT DEP as part of our August 2001 annual submittal.

Sample locations are shown on Figure 2, Site Plan. The rationale for the sample locations was as follows:

Monitoring Wells

- GZ-1 was installed in an inferred upgradient location.
- GZ-2 was installed in an inferred downgradient direction from the 20,000-gallon fuel oil UST.
- GZ-3 was installed in an inferred downgradient direction from the IWS unit, abandoned 1,500-gallon UST and former leaching pit.
- GZ-4 was installed in an inferred downgradient direction from the drainage ditch that may have received non-contact cooling water and chiller condensate discharge.
- GZ-5 was installed in an inferred downgradient direction from the less than 90-day waste storage area.
- GZ-6 was installed in an inferred downgradient direction from the facility transformers and mechanical room.
- GZ-7 was installed in an inferred downgradient direction from the former swimming pool chemical test pools.
- GZ-8 was installed in the vicinity of the former tertiary recovery tank that was formerly associated with Arch's original less than 90-day storage area.
- GZ-9 was installed in an inferred downgradient direction from the former treatment pits and test well.
- GZ-10 and GZ-11 were installed within the facility's former leaching field.

Hand Auger Samples

- HA-1 was a hand auger sample collected from outside the IWS unit near a foundation crack.
- HA-2, HA-3, HA-4 and HA-7 were hand auger samples collected outside the original less than 90-day storage area.
- HA-5 and HA-6 were hand auger samples collected near the facility transformers.

Wells GZ-1 through GZ-7 were installed and sampled in October 1999 and wells GZ-8 to GZ-11 were installed and sampled in December 1999. Wells GZ-3, GZ-6 and GZ-7 were also re-sampled in December 1999.

Soil Results

A summary of soil data for the site is presented in Table 1. No volatile organic compounds (VOCs), pesticides, polychlorinated biphenyls (PCBs) or total petroleum hydrocarbons (TPH) were detected in soil. Two polynuclear aromatic hydrocarbons (PAHs) were detected in soil near the original less than 90-day storage area at concentrations far below applicable RSR criteria and three metals (barium, chromium and lead) were detected at concentrations that are consistent with natural background.

Groundwater Results

A summary of groundwater data for the site is presented in Table 2. Groundwater results demonstrate the presence of chlorinated and non-chlorinated VOCs in GZ-3 at concentrations below applicable RSR criteria. Chloroform and bromodichloromethane were detected in GZ-7 at concentrations below applicable RSR criteria. One VOC [4-isopropyltoluene (4-IPT)] was detected in GZ-8 at a concentration below applicable RSR criteria. Total xylenes and 4-IPT were detected in GZ-9 at concentrations below applicable RSR criteria. Three chlorinated VOCs [1,1-dichloroethene (DCE), 1,1-dichloroethane (DCA) and 1,1,1-trichloroethene (TCA)] as well as 4-IPT were detected in GZ-10. Of the chlorinated compounds, DCE exceeded its residential volatilization criteria (RVC) of 1 part-per-billion (ppb) at a reported concentration of 2.1 ppb in one round. DCE in GZ-10 was below its industrial/commercial volatilization criteria (I/C VC) of 6 ppb and was below detection limits (det. lim. < 2ppb) in four subsequent consecutive sampling rounds.

3.2 ENSR, Phase III Transfer Act Site Assessment, July 2001

Subsequent to the submittal of the LEP-lead schedule, ENSR completed a Phase III work plan that was designed to further evaluate and build upon the work completed by GZA. The Phase III report was submitted to CT DEP as part of ENSR's August 2001 annual submittal. The Phase III Work Plan was implemented in April 2001. The Phase III Investigation included the installation of additional monitoring wells to evaluate the extent of contaminants in groundwater, sampling of soils in potential source areas including the former 1,500-gallon UST/leaching pit/IWS unit, the former septic system tank and the former treatment pits beneath the floor of the facility, survey of new and existing wells and groundwater sampling.

The following bullets summarize the findings of the Phase III investigation. Summary analytical data tables for soil and groundwater are presented in Tables 1 and 2, respectively.

- During the Phase III subsurface investigation, only one contaminant (dieldrin) was detected on-site in soil or groundwater at levels exceeding the GBPMC remedial criteria. A wastewater sample collected from a former septic tank exhibited minimal evidence of TPH contamination. In addition, evaluation of soil adjacent to and beneath the UST/ leaching pit/ IWS Unit, groundwater from the test well, and soil from the former sub-floor treatment pits showed no data above RSR criteria. Accordingly, no on-going sources of contamination that require remediation to achieve RSR criteria were identified.
- Dieldrin was detected in the soil sample collected from boring GP-2 (near the interim waste storage unit) at a concentration of 30 micrograms per kilogram ($\mu\text{g/kg}$), which is below the RDEC, but above the PMC. Two other pesticides, 4,4-DDD and 4,4-DDE were also detected at concentrations well below their respective RDEC. However, neither compound has a PMC established. Pesticides were not detected in any other soil samples tested nor were they detected in groundwater samples collected from the vicinity (wells MW-1 or GZ-3). In ENSR's opinion, the detection of pesticides in this sample is not a result of activities conducted at the Arch establishment, but likely from the historic agricultural use of the property. No pesticides were detected in the soil samples collected under the IWS and no other compounds were detected above RSR criteria. As such, ENSR sought to rule out these three pesticides as compounds of concern (COCs) for the site and proceed with the site Verification Report to achieve regulatory closure for the site under the Connecticut Property Transfer Act. This area was further investigated in a subsequent investigation (discussed below).

- VOC concentrations detected in well GZ-3 were similar to those previously detected by GZA and were below applicable RSR criteria. No VOCs were detected above or approaching RSR criteria in MW-1, located downgradient of well GZ-3. None of the organic contaminants detected in groundwater were detected in soil in the vicinity of GZ-3. It was ENSR's opinion that the former 1,500-gallon UST and leaching pit last operated by Siemens prior to 1983 are the likely sources of the compounds detected in GZ-3. However, soil samples collected relative to these historic features did not identify any source of contaminants that requires remediation under the RSRs.
- No VOCs were detected in well GZ-10, where 1,1-DCE had previously been detected by GZA at a concentration equal to the RVC. Additionally, with the exception of GZ-3, no VOCs were detected in any of the wells where GZA had detected them previously.
- Datagaps identified in the conceptual site model were addressed with the exception of evaluation of soil immediately beneath the floor slab of the IWS unit. Borings at this location were moved to the outside of the building due to the pending RCRA Closure Work Plan that is currently under review by CT DEP. This area was investigated in a subsequent investigation (discussed below).

3.3 ENSR, Quarterly Groundwater Monitoring Reports, July 2001, November 2001, and February 2002

The first quarterly groundwater monitoring event consisted of data obtained during the Phase III investigation, described above. The July 2001 report was included in ENSR's August 2001 annual submittal to CT DEP. The November 2001 and February 2002 quarterly monitoring event reports were included in ENSR's August 2002 annual submittal to CT DEP. Groundwater data from all of the monitoring events is summarized on Table 2. A groundwater contour map generated using data from the most recent event is included as Figure 3.

The following paragraphs discuss the results of the final quarter of groundwater monitoring and reference historical detections throughout the monitoring program:

- As seen in earlier sampling events, barium, chromium, nickel, and zinc were detected in many of the groundwater samples at levels that were consistent across the site, suggesting that they are background levels. The metal cadmium, which was detected once in well GZ-10 in 1999 in excess of the SWPC, was detected during the February 2002 round in well GZ-7 in excess of its SWPC. In ENSR's opinion, the detection of cadmium above the SWPC in well GZ-7 does not require additional evaluation since it is not detected in well MW-2, which is directly downgradient. The SWPC applies to a

groundwater plume that is discharging to surface water. Since no cadmium has been detected in well MW-2 in consecutive sampling rounds, it is ENSR's opinion that there is no plume of cadmium that is discharging to surface water at the site. Therefore the SWPC does not apply to cadmium in groundwater at well GZ-7.

- The compound 1,1-dichloroethene, which was detected in well GZ-10 at a level greater than its RVC in October 1999 by GZA, was not detected in any sampling events subsequent to 1999.
- Toluene was detected in wells MW-2, MW-3, and GZ-3 at concentrations below applicable RSR criteria. This compound has been detected in wells GZ-3 and MW-1 during previous sampling events, but has not historically been present in wells MW-2 and MW-3.
- Ethylbenzene, an additional aromatic VOC, was detected in well GZ-3. The detected concentration was below applicable RSR criteria and was lower than concentrations detected during previous sampling events. Also consistent with previous sampling events, a number of additional VOCs were detected in well GZ-3 at levels below applicable RSR criteria. A trace level of 1,1-dichloroethane, one of the VOCs present in well GZ-3, was also detected in well GZ-10 during the current sampling event and previous events. A low level of 1,1,1-trichloroethane was also detected in well GZ-10. This compound was also detected in this well in December 1999, but has not been detected in any other on-site wells.
- A low level of chloroform was detected in well GZ-7. Chloroform has been detected in this well at a concentration below its RSR residential volatilization criterion (RVC) in all of the consecutive quarterly sampling events; however, exceeded its RVC in October 1999.
- Small amounts of acetone were detected in wells MW-3 and GZ-10. A trace level of 2-Butanone (MEK) was also detected in well GZ-10. These compounds have not been detected at the site in any of the five previous sampling rounds. In ENSR's opinion, based on their absence in previous rounds, these compounds were likely introduced to the samples from an external source and they are not present in groundwater.
- Low levels of chloroethane, cis-1,2-dichloroethane, isopropylbenzene, 1,3,5-trimethylbenzene, and 1,2,4-trimethylbenzene were detected in well GZ-3 below the CTDEP's proposed RVC.

- Low levels of 4-IPT were detected during the first sampling event (December 1999) in wells GZ-8 through GZ-10 below the CTDEP's proposed RVC. 4-IPT was not detected in any of the subsequent sampling events.

In summary, upon the conclusion of the fourth quarter of groundwater monitoring and the results described above, ENSR concluded that compliance with the RSR has been achieved with regard to site groundwater.

3.4 ENSR, Additional Subsurface Investigation of the Former Interim Waste Storage Unit, February 2002

During the Phase III, ENSR detected volatile organic compounds (VOCs) at levels below applicable standards in a monitoring well GZ-3, installed proximal to the inactive IWS unit. The lack of any VOCs in soil in close proximity to the IWS unit and the highly localized nature of the groundwater contamination detected supports a conclusion that there is not a significant release in this area. However, in order to satisfy Connecticut Transfer Act Guidance, more direct evaluation of the potential source of the groundwater contamination was deemed necessary. It had been assumed in the Phase III report that such an investigation would be completed when the RCRA Closure of this unit was conducted; however, as the plan was still not approved by CT DEP, Arch instructed ENSR to conduct an evaluation of this unit to satisfy Transfer Act requirements. Accordingly, ENSR conducted the subsurface investigation of soil located directly beneath the IWS unit that was originally recommended in our Phase III work plan, dated January 2001.

The investigation consisted of the advancement of two soil borings through the floor of the unit using Geoprobe techniques. One boring was advanced through a crack or seam in the floor that had been repaired and the other was advanced adjacent to a sump located at the southern end of the storage unit floor. Each boring was advanced to the water table. The concrete floor of the IWS unit was observed to be approximately 24 inches thick. Soil beneath the floor consisted of brown/red medium sand with some silt to a depth of four feet below the floor. The brown/red sand overlies dark brown fine sand and silt to a depth of six feet. The dark brown fine sand layer in turn overlies a light brown fine sand and silt layer that was encountered to the bottom of the borings at eight feet below the floor. No visual or olfactory evidence of contamination was identified during drilling activities and no PID readings above background levels were recorded.

No VOCs, TPH, SVOCs, pesticides/PCBs, or cyanide were detected in the two soil samples collected from the capillary fringe beneath the IWS unit. Barium, chromium, and lead were detected in both of the soil samples analyzed for metals at levels below applicable RDEC and I/CDEC RSR criteria. The concentrations detected are similar to those detected elsewhere on site. The relatively narrow concentration range of metals

detected and widespread distribution of metals on the site is indicative of background concentrations, in ENSR's opinion. Based on the additional subsurface investigation and the soil borings completed as part of the Phase III investigation, there is no data to suggest that the compounds detected in groundwater collected from well GZ-3 are the result of a release from the IWS unit. In ENSR's opinion, the IWS unit is not the source of a release to the site.

3.5 HRP Associates, Inc., RCRA Closure of Former <90 Day Hazardous Waste Container Storage Area, May 15, 2002

In late 2000, when the site was sold and Alexion became a tenant at the subject property, Arch relocated their <90-day waste storage room. The < 90-day waste storage room was formerly located in the south side of the site building. This room was constructed such that its entire floor functioned as secondary containment. In addition, drip pans were placed beneath all containers. The room also has a drain that led to an outside UST that functioned as tertiary containment. According to Arch personnel, this tertiary containment UST was never used and was removed in 1993. No soil or groundwater samples were reported to have been collected upon removal of this tank. A virgin chemical storage room was also located in the southern side of the building. Arch has no record of a spill from this room. In May 2002, HRP Associates, Inc. (HRP) completed a RCRA Closure of the former <90-day storage area. The following activities were conducted during the investigation:

- Four concrete chip samples were collected from the floor of the <90-day storage area and analyzed for Appendix IX compounds in order to identify compounds of concern (COCs) not previously detected on-site. Beryllium, cobalt, lead, and vanadium were detected in the concrete chip samples and were added to the COC list.
- HRP observed one crack in the concrete floor of the <90-day storage area. Two soil samples were collected from beneath the crack in order to determine if the soil beneath the crack had been impacted by former hazardous waste storage activities. The two soil samples were analyzed for all of the COCs identified by HRP. In addition, metals were analyzed by the Synthetic Precipitation Leaching Procedure (SPLP). None of the COCs were detected above the RDEC or the GBPMC; therefore, clean closure by the ingestion and dermal contact pathway was achieved.
- Seven concrete chip samples were collected from the floor of the <90-day storage area and analyzed for Appendix IX compounds in order to determine if the concrete floor of the <90-day storage area was impacted from former hazardous waste storage activities. None of the COCs were detected above the RDEC or the GBPMC; therefore, clean closure by the ingestion and dermal contact pathway was

achieved.

- In order to satisfy the CT DEP RCRA <90 day Storage Unit Closure Guidance, the theoretical concentration of each volatile contaminant was calculated and compared to inhalation closure standards. The calculated theoretical concentrations for each detected volatile organic were below their respective inhalation closure standard; therefore, clean closure was achieved by the inhalation pathway.

In ENSR's opinion, based on the results of HRP's RCRA Closure, and evaluation of data from nearby areas, the <90-day storage area is not the source of a release to the site.

3.6 ENSR, Limited Dieldrin Investigation near the Former Interim Waste Storage Unit, December 2003

In December 2003, ENSR installed an additional three borings in the vicinity of boring GP-2 in order to further investigate the detection of dieldrin above the PMC as well as 4,4-DDD and 4,4-DDE, which have no PMC, from a sample collected in April 2001 from boring GP-2.

The RSR allows alternatives to be used in specific circumstances demonstrate compliance with the RSR. RSR section 22a-133k-2(c)(2)(D) provides for analysis by synthetic precipitation leaching procedure (SPLP) and then comparison to:

1. ten times the Groundwater Protection Criterion (GPC) for a given substance; or,
2. multiplied by the ratio of the summation of the areas downgradient and upgradient of the release area provided that such ratio does not exceed 500.

Therefore, in order to utilize the above provision to demonstrate compliance with the GB PMC for the dieldrin detected in GB-2, additional testing was necessary. In addition, 4,4-DDD and 4,4-DDE have GPC and this technique may be used to evaluate RSR compliance for mobility, given the absence of available PMC. In December 2003, three borings were advanced in the vicinity of boring GP-2, where these pesticides were detected in April 2001. The samples were analyzed for pesticides by the Synthetic Precipitation Leaching Procedure (SPLP). No pesticides were detected above the laboratory detection limits in any of the three samples collected. The detection limits for the three pesticides detected in April 2001 were all below ten times their respective GPC, the alternate RSR criterion for dieldrin allowed by 22a-133K-2(c)(2)(D) in each of the samples. These data indicate that pesticides in soil are not leaching to groundwater. Please refer to Appendix B for a copy of the Limited Dieldrin Investigation report.

4.0 PRESENTATION OF SITE DATA AND DEMONSTRATION OF COMPLIANCE

Tables 1 and 2 present a summary of all analytical data collected as part of the investigations completed to date. The data show compliance with all applicable RSR criteria for the site. In ENSR's opinion, the relatively narrow range of concentrations of metals detected in soil at the site coupled with their widespread distribution at the site indicate that the concentrations detected are background. Nevertheless, ENSR compared the total metals concentrations to 20 times the GB PMC in order to see if the concentrations detected could potentially exceed these criteria. Based on this comparison it was observed that lead and chromium could potentially exceed their respective GB PMCs. As a result, ENSR submitted soil samples with levels of lead and chromium in excess of 20 times the GB PMC for synthetic precipitation leaching procedure (SPLP) extraction and analysis. Samples submitted included GP-1 through GP-3 for lead and GP-3 for chromium. The results for these samples were below detection limits for both metals. Therefore, it is ENSR's opinion that compliance with the GB PMC has been demonstrated for all metals detected at the site.

Table 2 presents the historic groundwater data for all wells sampled at the site. As shown on the table, 1,1-DCE in GZ-10 and chloroform in GZ-7 are the only VOCs that have ever shown an exceedance of an RSR criteria at the site. Both of these compounds exceeded the RVC in the October 1999 sampling round but were below the I/C VC. In all subsequent sampling rounds neither of these compounds exceeded the RVC. Two metals (lead in GZ-3 in October 1999 and cadmium in GZ-10 in December 1999) exceeded the SWPC in the GZA's sampling rounds. These samples were collected using bailers, which produce a silty sample. Four subsequent rounds collected by low flow techniques did not detect either metal. As discussed in Section 3.0, cadmium exceeded the SWPC in GZ-7 in February 2002. This metal had not been detected previously in this well in five prior rounds. In ENSR's opinion, since there is a well downgradient of GZ-7 in which cadmium has not been detected in four sampling rounds, the SWPC does not apply to the GZ-7 cadmium data from February 2002.

Note that there are several compounds detected in well GZ-3 that do not have RVC or ICVC. These criteria apply to this location based on the depth of groundwater (<15 feet). These compounds cis-1,2-dichloroethene, isopropylbenzene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, are not detected in well MW-2 in four sampling rounds which is located downgradient, therefore, the SWPC does not apply to these data. In order to demonstrate whether RSR compliance existed at GZ-3, ENSR generated RVCs for these compounds, which were submitted in December 2002 to the commissioner for review and approval. In April 2003 ENSR received a letter from the DEP stating that in March 2003 the DEP issued proposed revised volatilization criteria. The revised list includes all of the substances for which ENSR requested RVCs be generated.

Therefore, rather than approving the ENSR-calculated RVC, the DEP approved the use of the proposed RVCs for the above-referenced compounds at the subject property. A copy of the DEP approval letter is included in Appendix C. The RVC values for these compounds are presented on Table 2. None of the RVC values were exceeded in any sampling round GZ-3. Based on the above, it is ENSR's opinion that compliance with RSR criteria for groundwater at the site has been demonstrated and remediation is not necessary.

The CSM included in ENSR's Phase III Work Plan identified four areas of concern (AOCs) in which contaminant releases had been identified at site. As described below, compliance with the RSR has been demonstrated in each of these AOCs through site assessment activities. In addition, investigations conducted at the site have addressed several Potential Areas of Concern (PAOCs) where oil and/or hazardous materials were handled but not known to have been released. The site assessment activities have also addressed these areas.

4.1 AOC Source Evaluation Sampling

Each of the AOCs was assessed by ENSR during the Phase III investigation, groundwater monitoring, and/or the additional subsurface investigation discussed in Section 3.0. The following sections provide a description of the findings of these investigations with regard to each AOC.

4.1.1 Former Interim Waste Storage Unit Sampling

Chlorinated and non-chlorinated VOCs have historically been present at concentrations below RSR criteria in well GZ-3, which is located downgradient of the former IWS unit. In order to determine whether the IWS unit was a source of the VOCs, ENSR advanced soil borings through the concrete floor of the unit. Boring locations were selected based on potential migration routes to the subsurface (a crack in the floor and a sump). No VOCs were detected above laboratory minimum detectable levels in either sample, both collected within the capillary fringe of the groundwater table. In addition, three soil borings GP-1 to GP-3 were advanced outside of the IWS to address both this unit and the former 1,500-gallon UST and leaching pit that had reportedly been used by Siemens. GP-1 to GP-3 were advanced to the water table and samples collected above the capillary fringe.

Dieldrin was detected in the soil sample collected from boring GP-2 at a concentration of 30 µg/kg, which is below the RDEC, but above the PMC. Two other pesticides, 4,4-DDD and 4,4-DDE were also detected at concentrations well below their respective RDEC. The pesticide 4,4-DDD was also detected in soil in GP-1 at a concentration well below

its RDEC. Neither compound has a PMC established. These pesticides have never been utilized by Arch, and have not previously been identified as compounds of concern (COC). Dieldrin and 4,4-DDD were used for agricultural purposes from the 1950s through the 1970s. 4,4-DDE is a biodegradation product of DDT and DDD. Prior to development for industrial/commercial use, the land on which the Arch facility is situated was formerly utilized for agricultural purposes. From the 1950s until 1970, these pesticides were widely used for crops like corn and cotton. Because of concerns about damage to the environment and potentially to human health, EPA banned all uses of aldrin and dieldrin in 1974, except to control termites. In 1987, EPA banned all uses. EPA also banned the use of 4,4-DDD in the early 1970s.

Concentrations of pesticides were not detected in the soil sample from GP-3, or the borings beneath the IWS unit, which were collected in the immediate vicinity of GP-2 and GP-1. It should be noted that the detection limits for dieldrin in the soil samples GP-1 and GP-3 were slightly greater than the PMC; however, postulating that these samples contained dieldrin at a concentration of $\frac{1}{2}$ the detection limit, they would be below the PMC. In addition, dieldrin has not been detected in groundwater samples collected from down-gradient wells MW-1 or GZ-3. In ENSR's opinion, the detection of dieldrin in this sample is not a result of activities conducted at the Arch establishment, but from the historic agricultural use of the property. No pesticides were detected in the soil samples collected under the IWS and no other compounds were detected above RSR criteria.

Never the less, although pesticides are not specifically compounds that resulted from the industrial/commercial uses of the property and thus would not be considered compounds of concern (COC) for the site, ENSR undertook additional testing to determine compliance with RSR criteria for pesticides to achieve regulatory closure for the site under the Connecticut Property Transfer Act. In December 2003, three boring were advanced in the vicinity of boring GP-2, where the dieldrin exceedance was detected in April 2001. The samples were analyzed for pesticides by SPLP. Dieldrin was not detected above the laboratory detection limits in any of the three samples collected. The detection limits were below ten times the GPC, the alternate RSR criterion for dieldrin allowed by 22a-133K-2(c)(2)(D) in each of the samples. These data indicate that dieldrin in soil is not leaching to groundwater. Thus compliance with RSR criteria has been demonstrated for the pesticides detected in GP-1 and GP-3.

Based on the investigations performed, it is ENSR's opinion that the IWS unit is not the source of a release to the site. The distribution of contaminants found in groundwater at the site indicate that the closed in place 1,500-gallon UST and/or leaching pit used by Siemens are likely the source of contamination observed in GZ-3 and landscaping activities and/or historic agricultural use are the likely source of the pesticides observed. However, the investigations completed by both GZA and ENSR indicate that no

remediation is required relative to these historic features since the investigation of this area has been thorough and RSR criteria are met in soil and groundwater.

4.1.2 Former Swimming Pool Chemical Testing Area Sampling

Chloroform was detected in well GZ-7, located downgradient of the former swimming pool chemical testing areas, at concentration above RSR criteria by GZA. Four quarterly groundwater monitoring events conducted by ENSR demonstrated that the level of chloroform has declined to well below RSR criteria. Well GZ-5 is located in an upgradient position relative to this AOC and MW-3 was installed to further evaluate potential source concentrations in this AOC. In addition, well MW-2 was installed in a downgradient position relative to this AOC. In ENSR's opinion, this combination of monitoring wells demonstrates that there is not a residual source area of chloroform present relative to the former test pools and that groundwater in this AOC is in compliance with RSR criteria.

4.1.3 Former Treatment Pit and Test Well Sampling

Non-chlorinated aromatic VOCs have historically been present in well GZ-9, located downgradient of the former treatment pits within the site building, at concentrations below RSR criteria. In order to determine whether the treatment pits were a source of the VOCs and whether there were higher concentrations of VOCs present that might require remediation, ENSR advanced soil borings through the pits. No VOCs were detected above laboratory minimum detectable levels in these samples, which were collected at a depth corresponding to the base of the pits (four feet). Accordingly, it is ENSR's opinion that the treatment pits are not a source of a release to the site. ENSR also sampled groundwater in the former test well, which is located in the same lab area as the former treatment pits and the sample collected from this well found no detectable levels of VOCs, TPH or cyanide. The only analyte detected in this well was barium which was detected at a concentration similar to other on-site wells, suggesting it is due to background concentrations.

4.1.4 Septic Tank Sampling

Dichloroethylene was detected in well GZ-10, located within the former septic leaching field, at concentration above its RVC by GZA. A number of additional VOCs were also detected in this well at levels below RSR criteria. ENSR accessed the on-site 10,000-gallon former septic tank and attempted to identify remaining sludge in the tank; however, none was recovered. Therefore, ENSR collected a sample of the wastewater in the tank and submitted it for analysis. No VOCs were detected in this wastewater sample. In addition, no VOCs above applicable RSR criteria were detected in samples

collected from wells GZ-10 and GZ-11 during the Phase III investigation or subsequent quarterly sampling. Based on the available data, the septic system does not appear to be a source of a release to the site requiring remediation or further evaluation.

4.2 PAOC Sampling

Each of the PAOCs was assessed either by GZA during their Phase II investigations or by ENSR during the Phase III investigation, groundwater monitoring, and/or the additional subsurface investigation discussed in Section 3.0. The following sections provide a description of the findings of these investigations with regard to each PAOC.

4.2.1 Former Less Than 90-day Waste Storage Room and Virgin Chemical Storage

The former less than 90-day waste storage room and the virgin chemical storage room were located in the southern portion of the building. GZA evaluated this area through the installation of monitoring well GZ-8 and the collection of soil samples from adjacent areas. Four hand auger samples were collected from this vicinity, HA-2, HA-3, HA-4 and HA-7. No compounds of concern were detected above RSR criteria in any of these samples or in groundwater collected from GZ-8. The most likely route for a release to reach the environment would have been through the tertiary containment UST system, if it had been used and if it had a failure. This UST was removed in 1993. Arch personnel reported that it had never been used and the observations made upon its removal indicate that it was not a source of release to the site. No soil or groundwater samples were reported to have been collected upon removal of this tank. However, the soil and groundwater samples collected from GZ-8 and the hand auger borings in the area of the tank provided data on this PAOC during Transfer Act investigation of the site.

In late 2000, when the site was sold and Alexion became a tenant at the subject property, Arch relocated their <90-day waste storage room. The < 90-day waste storage room was formerly located in the south side of the site building. This room was constructed such that its entire floor functioned as secondary containment. In addition, drip pans were placed beneath all containers. The room also has a drain that led to an outside UST that functioned as tertiary containment. According to Arch personnel, this tertiary containment UST was never used and was removed in 1993. No soil or groundwater samples were reported to have been collected upon removal of this tank. A virgin chemical storage room was also located in the southern side of the building. Arch has no record of a spill from this room. In May 2002, HRP Associates, Inc. (HRP) completed a RCRA Closure of the former <90-day storage area. The following activities were conducted during the investigation:

- Four concrete chip samples were collected from the floor of the <90-day storage

area and analyzed for Appendix IX compounds in order to identify compounds of concern (COCs) not previously detected on-site. Beryllium, cobalt, lead, and vanadium were detected in the concrete chip samples and were added to the COC list.

- HRP observed one crack in the concrete floor of the <90-day storage area. Two soil samples were collected from beneath the crack in order to determine if the soil beneath the crack had been impacted by former hazardous waste storage activities. The two soil samples were analyzed for all of the COCs identified by HRP. In addition, metals were analyzed by the Synthetic Precipitation Leaching Procedure (SPLP). None of the COCs were detected above the RDEC or the GBPMC; therefore, clean closure by the ingestion and dermal contact pathway was achieved.
- Seven concrete chip samples were collected from the floor of the <90-day storage area and analyzed for Appendix IX compounds in order to determine if the concrete floor of the <90-day storage area was impacted from former hazardous waste storage activities. None of the COCs were detected above the RDEC or the GBPMC; therefore, clean closure by the ingestion and dermal contact pathway was achieved.
- In order to satisfy the CT DEP RCRA <90 day Storage Unit Closure Guidance, the theoretical concentration of each volatile contaminant was calculated and compared to inhalation closure standards. The calculated theoretical concentrations for each detected volatile organic were below their respective inhalation closure standard; therefore, clean closure was achieved by the inhalation pathway.

In ENSR's opinion, based on the results of GZA's investigation and HRP's RCRA Closure, and evaluation of data from nearby areas, the <90-day storage area is not the source of a release to the site.

4.2.2 20,000-Gallon Fuel Oil UST

The 20,000-gallon fuel oil UST was installed in 1993. It is constructed of cathodically-protected steel. Well GZ-2 was installed by GZA immediately downgradient and adjacent to the UST. No analytes were detected in groundwater in this well. Based upon investigations performed at the site and the construction of the UST, it is not a source of release to the site, in ENSR's opinion.

4.2.3 Non-Contact Cooling Water and Chiller Condensate Discharge

This area was reported by GZA to have received chiller condensate and non-contact cooling water discharge from a floor drain in the mechanical room. This drain was believed to be connected to the sanitary sewer system however, it was not. Consequently, from 1984 to 1988, this water was discharged to a drainage ditch located to the southeast of the facility. Approximately 4,000-gallons per day for approximately 150 days per year were discharged. The water was reported to contain zinc at a

concentration of 0.5 mg/L, chlorine, and phosphonate. Well GZ-4 was installed in this area and sampled by GZA in October 1999. With the exception of barium, no analytes were detected in groundwater in this area indicating that there is no residue in the environment from this discharge that exceeds RSR criteria.

5.0 CONCEPTUAL SITE MODEL

A conceptual site model (CSM) was developed from existing data prior to the implementation of the Phase III Investigation. The purpose of the CSM is to be able to document to stakeholders (e.g. owners, CT DEP, tenants, etc) the process by which environmental issues at a site are identified, characterized, risks to receptors assessed and, if needed, remediated. The CSM is an iterative process that directs the site towards closure. Datagaps are highlighted by the CSM which, when investigated, focus the project on the next step. The datagaps identified by the CSM prior to the implementation of the Phase III investigation were as follows:

- The extent of VOCs detected in groundwater in the vicinity of the interim waste storage building/former 1,500-gallon UST/leaching pit area;
- The extent of dieldrin detected in soil in the vicinity of the interim waste storage building;
- The source of VOCs detected by GZA in the swimming pool chemical test area;
- The extent of VOCs in the vicinity of the former swimming pool chemical test area;
- The source of VOCs detected by GZA in well GZ-9; and,
- The rate of groundwater migration at the site.

These datagaps were presented in a matrix table in the Phase III Work Plan. Table 3 presents the matrix updated with information from the Phase III investigation, groundwater monitoring events, and additional subsurface investigation.

AOC	Source	Extent	Nature
Interim Status Waste Storage, Abandoned 1,500 gal UST, Former Leaching Pit	Impact to groundwater from one or more of these co-located features.	Confined to the vicinity of GZ-3. No contamination detected above RSR criteria in GW downgradient or in soil samples collected in the Phase III or additional investigation	VOCs in groundwater Below RSR Criteria
Interim Status Waste Storage	Historical agricultural use of the site	Dieldrin concentration detected in GP-2 above the PMC was not repeatable in three other samples located in the immediate vicinity of GP-2.	Dieldrin in soil below RSR Criteria
Swimming Pool Chemical Testing Area	No contaminants detected	No contaminants detected above RSR criteria downgradient.	VOCs in groundwater Below RSR Criteria
Test Well, Former Treatment Pit	No contaminants detected in the test well or soil within the former treatment pit	No contaminants detected in GZ-9 in the Phase III investigation	VOCs Below RSR Criteria
Leaching Field	Former discharge to septic tank, no contaminants detected	No contaminants detected in GZ-10 or GZ-11 in the Phase III investigation; low concentrations (below RSR criteria) in quarterly sampling	VOCs, One Above RVC in 1999, four consecutive quarters show compliance with RSR criteria


Although ENSR did not detect a release that is migrating, ENSR calculated the Rate of Migration using the average horizontal gradient and geologic logs. The estimated Rate of Migration for groundwater at the site is 2.07×10^{-1} feet per year to 4.93×10^{-1} feet per year.

Based on the above information, all of the datagaps that had existed prior to the Phase III investigation have been addressed and no exceedances of applicable RSR criteria have been identified for COCs at the site.

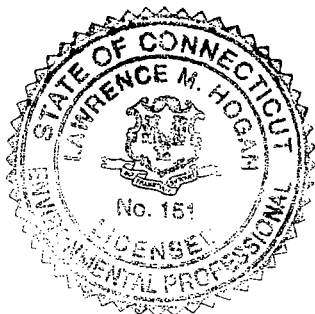
6.0 VERIFICATION STATEMENT

Based on the above, it is ENSR's opinion that the investigations conducted by Arch Chemical pursuant to CGS 22a-134a have been effective in demonstrating compliance with R.C.S.A. 22a-133k-1 to -3. Furthermore, it is ENSR's opinion that the investigation and remediation of the site has been conducted in accordance with the standard of care provided for in CGS 22a-133V (c). Therefore, in accordance with the Connecticut Transfer Act, Connecticut General Statutes Title 22a Section 22a-134 (19) and Regulations of Connecticut State Agencies 22a-133v-1(z), I am verifying that site work related to the Arch Chemical Form III filing in May 22, 2000 and July 21, 2000 facility is complete.

VERIFICATION


Lawrence M. Hogan, LEP License No. 151

3/30/04
Date



LEP Seal

TABLES

Table 1
Historic Summary
Soil Sample Analysis
350 Knotter Drive
Cheshire, Connecticut

DETECTED CONTAMINANTS	Date	SAMPLE LOCATIONS										RSR Remedial Criteria			
		GP-1 4/11/2001 0'-4'	GP-2 4/11/01 4'-8'	GP-3 4/11/01 12'-16'	GP-TP1 5/3/01 0'-4'	GP-TP2 5/3/01 0'-4'	HW-1 2/7/02 6'-8'	HW-2 2/7/02 6'-8'	GP-2A 12/19/03 7-8	GP-2B 12/19/03 7-8	GP-2C 12/19/03 7-8	RDEC	I/C DEC	GBPMC	10 X GPC
SVOCs (ug/kg)	Bis (2-ethylhexyl) phthalate	ND	ND	ND	ND	1,800	ND	ND	NA	NA	NA	44,000	410,000	11,000	NU
Pesticides (ug/Kg)	4,4-DDD	13	74	ND	ND	ND	ND	ND	<0.0100**	<0.0100**	<0.0100**	2,600	24,000	NE	1.5 **
	4,4-DDE	ND	37	ND	ND	ND	ND	ND	<0.0100 **	<0.0100 **	<0.0100 **	1,800	17,000	NE	1.0**
	Dieldrin	ND	30	ND	ND	ND	ND	ND	<0.00700**	<0.00700**	<0.00700**	38	360	7	0.020 **
Total Metals (mg/Kg)														GBPMC X 20	
	Cadmium	ND	0.778	ND	ND	ND	ND	ND	NA	NA	NA	34	1,000	1	NU
	Total Chromium	6.82	9.30	10.8	5.65	6.67	11.4	14.1	NA	NA	NA	NE	NE	10	NU
	Copper	12.2	9.69	12.8	6.76	8.14	ND	ND	NA	NA	NA	2,500	76,000	260	NU
	Lead	8.84	16.2	8.88	2.67	3.17	4.66	3.68	NA	NA	NA	500	1,000	3	NU
	Nickel	3.67	11.0	8.31	3.48	3.91	ND	ND	NA	NA	NA	1,400	7,500	20	NU
	Zinc	7.94	12.2	16.8	13.7	12.2	ND	ND	NA	NA	NA	20,000	610,000	1000	NU
	Barium	31.0	28.2	38.1	28.8	38.1	20.7	31.8	NA	NA	NA	4,700	140,000	200	NU
SPLP Metals (Mg/L)														GBPMC	
	Chromium	NA	NA	ND	NA	NA	NA	NA	NA	NA	NA	NE	NE	0.5	NU
	Lead	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NE	NE	0.15	NU

NOTES:

No ETPH, VOCs, Cyanide, PCBs, or leachable metals (by SPLP) were present at concentrations exceeding minimum detectable levels.

ETPH = Extractable Total Petroleum Hydrocarbons, analyzed by CT DEP Method

VOC = Volatile Organic Compounds, analyzed by EPA Method 8260B.

SVOC = Semi-Volatile Organic Compounds, analyzed by EPA Method 8270C.

PCB = Polychlorinated Biphenyls, analyzed by EPA Method 8082.

mg/Kg = milligrams per kilogram, equivalent to parts per million (ppm).

ug/Kg = micrograms per kilogram, equivalent to parts per billion (ppb).

ug/L = micrograms per liter, equivalent to ppb.

ND = Not Detected Above Minimum Detectable Levels

NE = None Established

NA= Not Analyzed

NU = Not Used

RDEC = Residential Direct Exposure Criteria

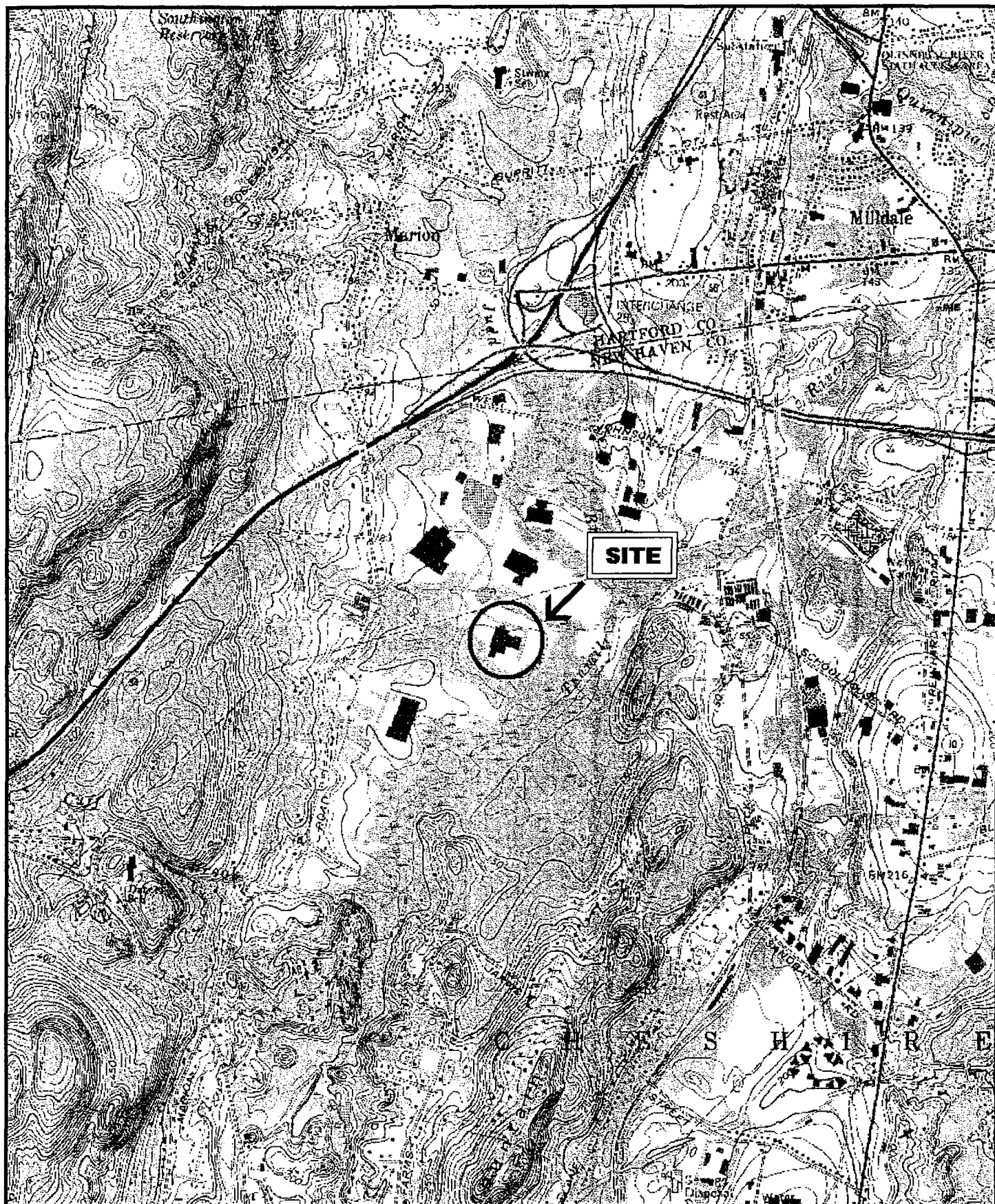
I/C DEC = Industrial/Commercial Direct Exposure Criteria

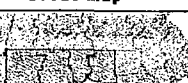


GB PMC x20 = 20 X Pollutant Mobility Criteria for GB classified groundwater areas (theoretical criterion)

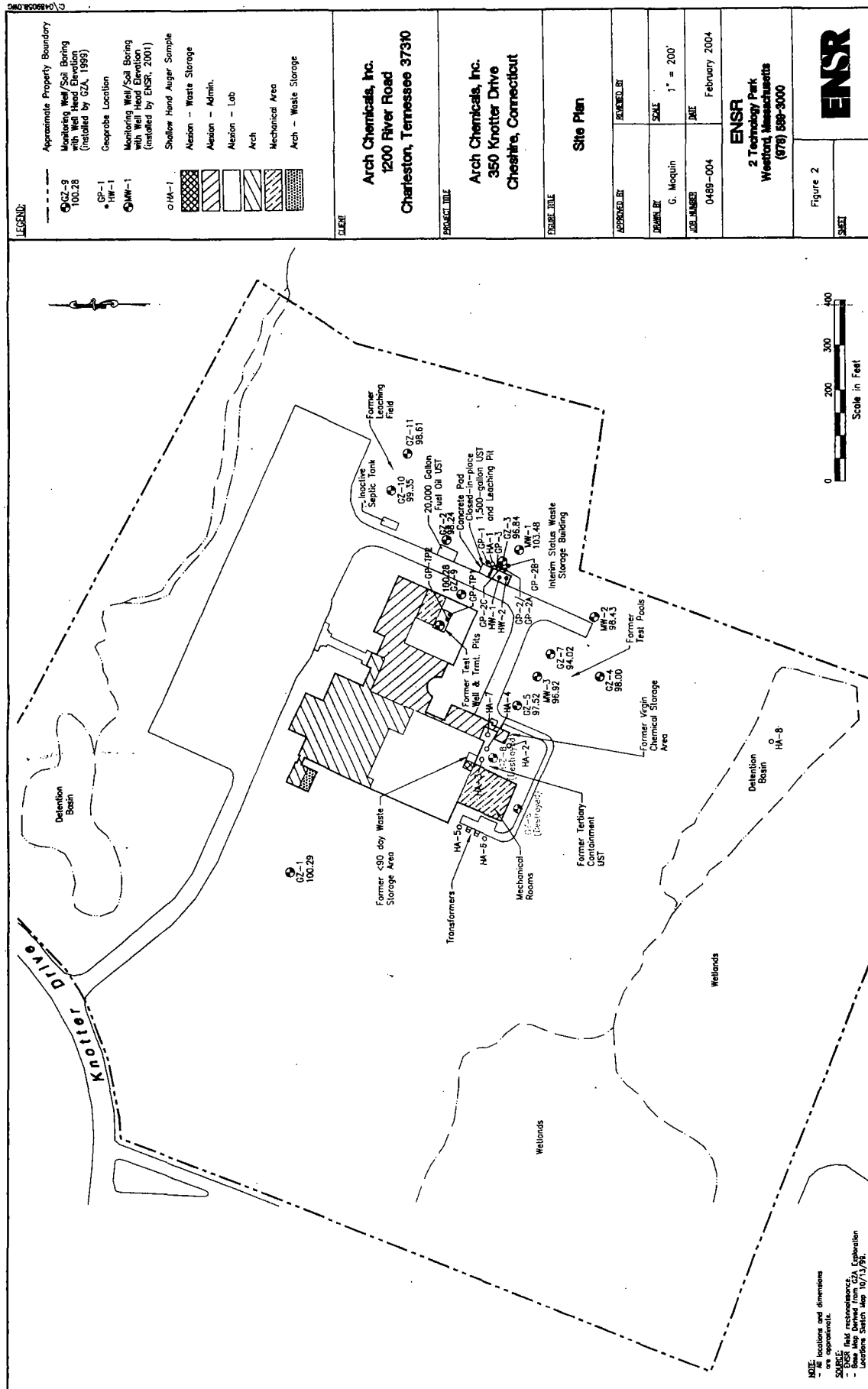
**concentrations reported in ug/L

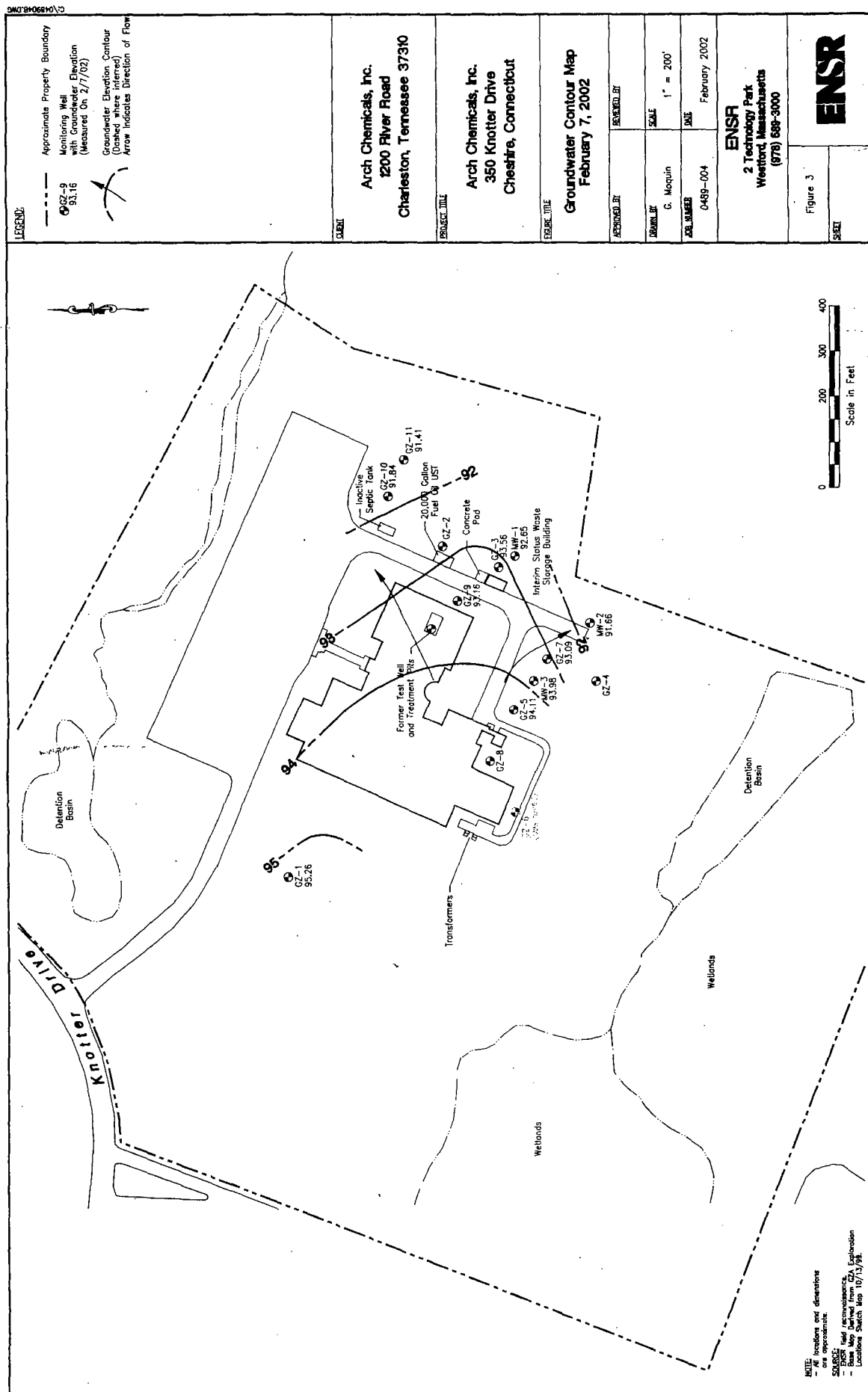
10 X GPC = Ten times the Groundwater Protection Criteria





Locus Map	Legend	LOCUS PLAN	
	Scale: 1 Inch = 2000'	350 Knotter Drive, Cheshire, Connecticut	
	 Feet		Figure No. 1
	Source: U.S.G.S. SOUTHTON, CT QUAD MAP (1992)		Date: November, 1999







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155 Otis Street
Northborough, MA 01532-2414

(508) 393-8558
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<http://www.ensr.com>

September 5, 2000

State of Connecticut
Department of Environmental Protection
Attn. Mr. Jan Michael Czeczotka
Bureau of Water Management
Permitting Enforcement and Remediation Division
79 Elm Street
Hartford, Connecticut 06106-5127

Re: LEP-Lead Schedule for Arch Chemical
350 Knotter Drive
Cheshire, Connecticut

Dear Mr. Czeczotka:

In response to your letter of July 31, 2000 and pursuant to the Connecticut Transfer Act 22a-134a(h), ENSR is submitting to the Connecticut Department of Environmental Protection (CTDEP) on behalf of Arch Chemicals, Inc. (Arch) the enclosed schedule for the above referenced property. The CTDEP's letter provided notification to Arch that a Licensed Environmental Professional (LEP) may verify the investigation and remediation (if required) of the property.

CTDEP sent the July 31st letter in response to a Form III and Environmental Condition Assessment Form (ECAF) filed for the subject property on May 22, 2000. The May 22nd filing was for transfer of the facility from Olin Corporation to Arch. Please note that a second Form III and ECAF filing for the property was forwarded to the CTDEP on July 21, 2000. This was for the transfer of the property from Arch to Winstanley Enterprises, LLC. In both filings, Arch was listed as the certifying party. The CTDEP sent a second letter to Arch indicating a LEP could verify the investigation and remediation of the site on August 15, 2000. Since Arch is the certifying party in both cases, ENSR is submitting the attached schedule on their behalf to fulfill the requirement stated in both the July 31st and August 15th CTDEP letters.

The attached site schedule has been prepared in accordance with CTDEP's draft schedule guidance and provides approximate dates, within the timeframes allowed by the Connecticut Transfer Act, Section 22a-134a(h), within which the property will be investigated and remediated (if required). All schedule dates are based on the date Arch received the July 31st CTDEP letter, August 5, 2000.

If you should have any questions, please do not hesitate to contact the undersigned.

Sincerely,

ENSR

Lawrence M. Hogan, LEP
Project Manager

Cc: Dan Bennewitz, Arch



**INVESTIGATION AND REMEDIATION SCHEDULE
350 KNOTTER DRIVE
CHESHIRE, CONNECTICUT**

Task	Estimated Schedule
Environmental Assessment and Site Investigations	Investigation of the facility pursuant to the Transfer Act will be completed by August 5, 2002 Note: Real Estate Phase I and Phase II was completed November 1999 and was used in the ECAF filings.
Site Remediation *	Feasibility Study for Remedial Measures (if required) and Initiate Remediation (if required) by: August 5, 2003
Provide Public Notice of Remediation (if required)	Public notice of remediation (if required) will be posted prior to the initiation of remediation in accordance with 22a-134a(j) of the CGS by: July 5, 2003
Technical Plans & Reports	Technical plans and reports related to the investigation and remediation (if required) at the parcel will be submitted to the Commissioner on an annual basis, beginning August 5, 2001
Verification	Verification to be submitted upon the completion of remediation and groundwater monitoring. Complete remediation (if required) by: August 5, 2005 Complete Any Additional Groundwater Monitoring (if required) by: August 5, 2006 Submit Verification by: October 5, 2006
The certifying party shall investigate and remediate the parcel in accordance with the proposed schedule. The Commissioner may approve in writing any modification proposed in writing by the certifying party to such schedule of investigation and remediation.	

January 19, 2004

ENSR International
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FAX (978) 589-3100
www.ensr.com

Mr. William Mitchell
Arch Chemicals, Inc.
1200 Lower River Road
Charleston, Tennessee 37310

**Re: Dieldrin Investigation Summary Letter
Arch Chemicals Facility, 350 Knotter Drive, Cheshire, Connecticut**

Dear Mr. Mitchell:

ENSR Corporation (ENSR) is pleased to present this letter summarizing a limited subsurface investigation in the vicinity of the former Interim Waste Storage Unit (IWS Unit) at the above-referenced site. The purpose of the investigation was to provide additional analytical data in order to demonstrate compliance with applicable Remediation Standard Regulation (RSR) criteria for the site. This letter provides a description of why the additional work was required, a summary of the tasks performed, and conclusions and recommendations relative to the results. This work performed is subject to ENSR's Service Constraints, which are included as Attachment I.

BACKGROUND INFORMATION

ENSR has been performing investigations at the property pursuant to the Connecticut Property Transfer Act. Please refer to Figure 1, Site Locus for the geographic location of the site. As part of these investigations, in April 2001, borings GP-1 to GP-3 were advanced to the water table and samples were collected above the capillary fringe in the vicinity of the former Interim Waste Storage (IWS) unit. Dieldrin was detected in the soil sample collected from boring GP-2 at a concentration of 30 micrograms per liter ($\mu\text{g/L}$), which is below the RDEC, but above the PMC. Dieldrin has never been utilized by Arch, and has not previously been identified as a compound of concern (COC). Dieldrin is a pesticide that was used for agricultural purposes from the 1950s through the 1970s. Prior to development for industrial/commercial use, the land on which the Arch facility is situated was formerly utilized for agricultural purposes. From the 1950s until 1970, aldrin and dieldrin were widely used pesticides for crops like corn and cotton. Because of concerns about damage to the environment and potentially to human health, EPA banned all uses of aldrin and dieldrin in 1974, except to control termites. In 1987, EPA banned all uses.

Dieldrin was not detected in any other soil samples tested nor was it detected in groundwater samples collected from the vicinity (wells MW-1 or GZ-3). In ENSR's opinion, the detection of dieldrin in this sample is not a result of activities conducted at the Arch establishment, but from the historic agricultural use of the property. No pesticides were detected in the soil samples collected under the IWS and no other compounds were detected above RSR criteria. As such, ENSR sought to rule out dieldrin as a compound of concern (COC) for the site and proceed with the site Verification Report to achieve regulatory closure for the site under the Connecticut Property Transfer Act. However, since the Verification Report will be subject to Connecticut Department of Environmental Protection (CTDEP) audit, ENSR contacted Mr. Ray Frigon

information be included in the verification report. Please refer to Attachment II for a copy of the laboratory analytical report.

CLOSING


We appreciate this opportunity to continue providing services to Arch. If you have any questions, please do not hesitate to contact the undersigned. We look forward to working with you on this project.

Sincerely,

ENSR Corporation



Michelle Snyder
Senior Staff Specialist
Project Coordinator



Lawrence M. Hogan, P.G., LEP
Senior Geologist
Project Manager

TABLE

Table 1
Soil Sample Analysis for Dieldrin
Arch Chemicals, Inc.
350 Knotter Drive
Cheshire, Connecticut

DETECTED CONTAMINANTS	SAMPLE LOCATIONS						RSR Remedial Criteria			
	GP-1 ug/kg 0'-4'	GP-2 ug/kg 4'-8'	GP-3 ug/kg 12'-16'	GP-2A ug/L 7'-8'	GP-2B ug/L 7'-8'	GP-2C ug/L 7'-8'	RDEC ug/kg	VC DEC ug/kg	GBPMC ug/kg	10 X GPC ug/L
Date	4/11/2001	4/11/2001	4/11/2001	12/19/2003	12/19/2003	12/19/2003				
Pesticides (ug/Kg)										
	<8.1	30	<9.0	<0.00700	<0.00700	<0.00700	38	380	7	0.020

NOTES:

ug/Kg = micrograms per kilogram, equivalent to parts per billion (ppb)

ug/L = micrograms per liter, equivalent to ppb.

<8.1 = Not Detected Above Minimum Detectable Levels

RDEC = Residential Direct Exposure Criteria

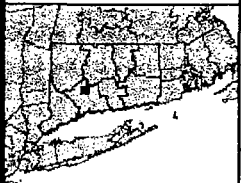

VC DEC = Industrial/Commercial Direct Exposure Criteria

GB PMC = Pollutant Mobility Criteria for GB classified groundwater areas

10 X GPC = Ten times the Groundwater Protection Criteria

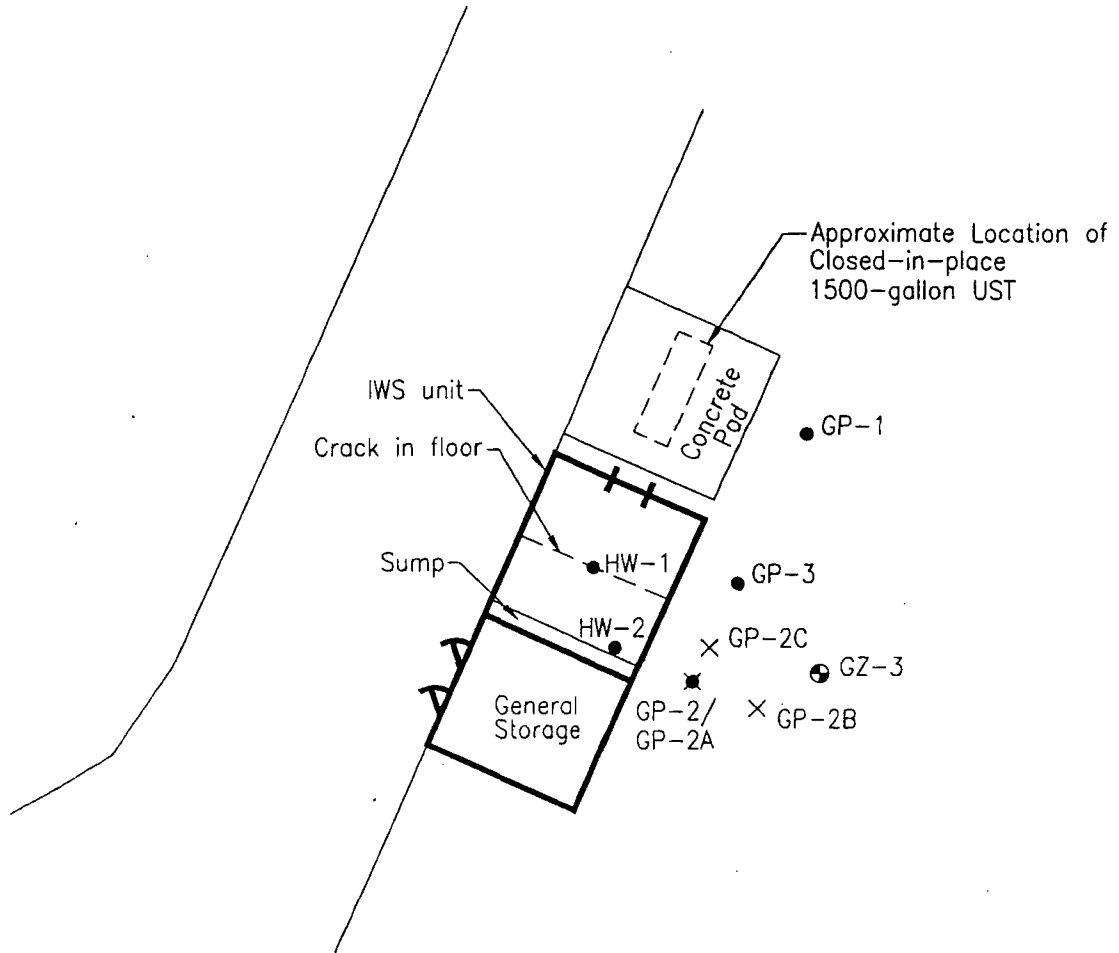
FIGURES



<p>Locus Map</p> 	<p>Legend</p> <p>Scale: 1 Inch = 2000'</p>  <p>Feet</p> <p>Source: U.S.G.S. SOUTHTON, CT QUAD MAP (1992)</p>	<p>LOCUS PLAN</p> <p>350 Knottter Drive, Cheshire, Connecticut</p> <p>ENSR INTERNATIONAL</p> <p>Figure No. 1</p> <p>Date: November, 1999</p>
-------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------

LEGEND:

- GZ-3 Monitoring Well/Soil Boring
- GP-1 Geoprobe Location Advanced 4/01
- HW-1
- × GP-2B Geoprobe Location Advanced 12/03
- ++ Bay Door
- Δ Swinging Door



NOTE:

- All locations and dimensions are approximate.

SOURCE:

- ENSR field reconnaissance.



Scale in Feet

Client:

Arch Chemicals, Inc.

IWS Unit Boring Plan

350 Knotter Drive
Cheshire, Connecticut

Figure 3

1" = 25'



January 2004

Job No. 0489-004

APPENDIX C

CTDEP Authorization Letter to Use Proposed RVC



STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WASTE MANAGEMENT



APPROVAL

April 10, 2003

Mr. Lawrence Hogan
ENSR
155 Otis Street
Northboro, MA 01532

*ENSR
2 Technology Park Drive
Westford, MA 01886*

Re: Additional Residential Groundwater Volatilization Criteria
350 Knotter Drive, Cheshire, CT

Dear Mr. Hogan:

The Department of Environmental Protection received your request on December 24, 2002 for approval of additional residential groundwater volatilization criteria for the following substances: isopropylbenzene (cumene); 4-isopropyltoluene; 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene; chloroethane and cis-1,2-dichloroethene. In conjunction with the Department of Public Health (DPH), the DEP has reviewed your request. Please refer to the attached memorandum from the Department of Health for detailed information regarding their review.

The DEP issued proposed revised volatilization criteria in March 2003. Please see the attached document for additional detailed information. The list of criteria was expanded and includes all of the substances for which additional criteria were requested. The approved target indoor air concentrations and residential groundwater volatilization (from the proposed revised criteria issued in March 2003) and hereby approved by the Department for use at the site located at 350 Knotter Drive in Cheshire, CT are as follows:

	Residential Target Indoor Air Concentrations ($\mu\text{g}/\text{m}^3$)	Residential Groundwater Volatilization Criteria ($\mu\text{g}/\text{l}$)
isopropylbenzene (cumene)	120	2800
4-isopropyltoluene	67	1600
1,2,4-trimethylbenzene	9.3	360
1,3,5-trimethylbenzene	9.3	280
Chloroethane	500	12000
cis-1,2-dichloroethene	18	830

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Nothing in this determination shall affect the authority of the Commissioner under any other statute or regulation, including, but not limited to, any authority to institute any proceeding, or take any other action to prevent or abate pollution, to recover costs and natural resource damages, and to impose penalties for violations of law. If at any time the Commissioner determines that the actions at the parcel have not fully characterized the extent and degree of pollution or have not successfully abated or prevented pollution, the Commissioner may institute any proceeding, or take any action to require further investigation or further action to prevent or abate pollution.

In addition, nothing in this determination shall relieve any person of his or her obligations under applicable federal, state and local law.

If you have any questions regarding this determination, please feel free to call Ruth Lepley Parks at (860) 424-3923.

Sincerely,

A handwritten signature in cursive script that reads "Elsie Patton".

Elsie Patton
Acting Director of the Planning & Standards Division
Bureau of Waste Management

Attachments

EP/rel

cc: Gary Ginsberg, Department of Public Health
Ray Frigon, PERD, CTDEP

MEMORANDUM

DATE: March 20, 2003

TO: Elsie Patton, Assistant Director; DEP/PERD.

THRU: Mary Lou Fleissner, Director; DPH/EEOH *mt*

FROM: *SC* Stewart Chute & *gls* Gary Ginsberg, Toxicologists; DPH/EEOH

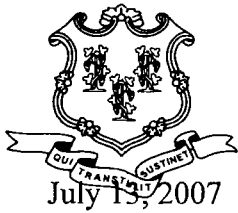
RE: Cleanup Criteria for Additional Polluting Substances:
350 Knotter Dr, Cheshire CT.

This memo is in response to DEP's request for review of proposed residential Groundwater Volatilization Criteria (GWVC) for six compounds detected at 350 Knotter Dr., Cheshire. These values were proposed in the 12/20/02 submittal from ENSR International. Though alternative GWVC values were submitted, DPH comments only on the Target Air Concentrations (TACs) used in the derivation of the alternative GWVC criteria.

The proposed TAC values are not approved because the default exposure parameter (IRair) needs to be adjusted, and because some RfDs need to be revised. DPH just completed a revision of the TACs which includes these and other factors for these specific additional polluting substances. The updated TACs for the VOCs at this site are listed in the attached table. Supporting documentation for these values is provided in Appendix B of CTDEP's "Proposed Revisions to CT's RSR Volatilization Criteria, draft date 3/18/03"

If you have questions, we can be reached at 509-7742.

CC: Ruth Parks



STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION



William Mitchell
Arch Chemicals Inc.
1200 Lower Ridge Road NW
P.O. Box 800
Charlestown, TN 37310

Re: Corrective Action - Well Survey, Quality Assurance Project Plan and Ecological Risk Assessment -
Arch Chemicals, Inc. 350 Knotter Drive, Cheshire, CT
EPA ID No. CTD98016799

Dear Mr. Mitchell:

The Department received the Drinking Water Well Survey, the Quality Assurance Project Plan (QAPP) and an Ecological Risk Assessment prepared by ENSR Corporation on May 4, 2007. The documents were submitted for compliance with RCRA Corrective Action requirements.

The QAPP was reviewed and is accepted by the Department. This obligation under RCRA Corrective Action is considered fulfilled.

The Ecological Risk Assessment is in review by the Department. Once it has been reviewed, a letter will be sent to you either accepting the report as submitted or ask for additional information.

The Well Survey has been reviewed. Based on the review, the following information is requested:

It was found that there were approximately 16 wells within a half-mile radius of the facility. Please provide the distance these wells are from the property line and their relationship to groundwater flow and the potential for impact to these wells.

In June 2004 the Department sent a letter to Arch Chemicals, Inc. acknowledging the remedial work that had been conducted under the Property Transfer Program. In addition to Property Transfer, this site is also subject to RCRA Corrective Action in accordance with the Code of Federal Regulations 40 CFR 264.101(a). The June 2004 letter identified the above three items as remaining issues for Corrective Action. Once this work is completed and public participation completed, a tentative determination will be made to terminate your RCRA permit application. This will result in termination of interim status. If you have any questions, please call me at (860) 424-3300.

Sincerely,

Sandra Brunelli
Environmental Analyst 3
Remediation Division
Bureau of Water Protection and Land Reuse

c: Ray Cody, EPA Region 1
Ms Michelle Snyder, Project Manager, ENSR, 2 Technology Park Drive, Westford, MA 01886-3140

ENSR

2 Technology Park Drive, Westford, Massachusetts 01886-3140
T 978.589.3000 F 978.589.3100 www.ensr.aecom.com

Letter of Transmittal

Attention: Sandra Brunelli Date: 5/2/2007

Project reference: Arch Chemical Project number: 00489-014
Cheshire, CT

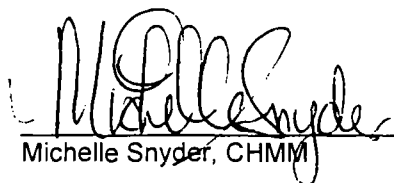
We are sending you the following:

Number of originals:	Number of copies:	Description:
<u>1</u>	<u>0</u>	<u>Well Survey, Quality Assurance Project Plan, and Ecological Risk Assessment Work Plan.</u>

As required by the Connecticut Department of Environmental Protection (CTDEP) Bureau of Materials Management and Compliance Assurance, in order to achieve site-wide closure under the Resource Conservation and Recovery Act (RCRA) and to terminate RCRA interim status, ENSR Corporation (ENSR) is providing the above-referenced documents on behalf of Arch Chemicals, Inc.

If you have any questions, please contact Michelle Snyder or Larry Hogan at 978.589.3000.

Sincerely,


Michelle Snyder, CHMM
Project Manager

RECEIVED

DEP-WASTE MANAGEMENT BUREAU
WASTE ENGINEERING & ENFORCEMENT

Needs to be Reviewed

Prepared for:
Arch Chemicals, Inc
Charleston, Tennessee

Ecological Risk Assessment Work Plan
350 Knotter Drive
Cheshire, Connecticut

ENSR Corporation
April 2007
Document No.: 00489-014-400

ENSR | AECOM

Prepared for:
Arch Chemicals, Inc.
Charleston, Tennessee

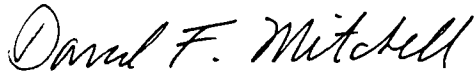
Ecological Risk Assessment Work Plan

350 Knotter Drive

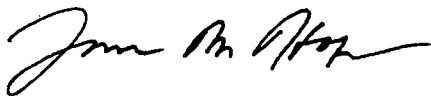
Cheshire, Connecticut



Prepared By
Christine R. Archer
Ecological Risk Assessor



Reviewed By
Dave F. Mitchell, PhD
Senior Ecologist



Reviewed By
Lawrence M. Hogan, LEP, PG
Senior Geologist

ENSR Corporation
April 2007
Document No.: 00489-014-400

Contents

1.0 Introduction	1-1
1.1 Site History.....	1-1
1.2 SERA Approach and Methodology	1-3
1.3 Organization of the SERA	1-3
2.0 Problem Formulation.....	2-1
2.1 Definition of Risk Assessment Objectives	2-1
2.2 Site Characterization and Definition of the Geographic Area to be Considered.....	2-1
2.2.1 Maintained Lawn Areas.....	2-2
2.2.2 Upland Wooded Areas	2-2
2.2.3 Ten Mile River Corridor	2-2
2.2.4 Impoundments.....	2-3
2.3 Selection of Specific Ecological Receptors and Exposure Pathways	2-3
2.3.1 Threatened/Endangered Species and Species of Special Concern	2-3
2.4 Selection of Assessment and Measurement Endpoints.....	2-4
2.5 Selection of COPCs.....	2-4
2.6 Conceptual Site Model	2-4
3.0 Risk Analysis.....	3-1
3.1 Terrestrial Receptor Risk Analysis.....	3-1
3.1.1 Soil Benchmark Screening.....	3-1
3.2 Aquatic Receptor Risk Analysis	3-1
3.2.1 Groundwater Benchmark Screening.....	3-1
4.0 Risk Characterization	4-1
5.0 References	2

List of Figures

Figure 1 Site Locus

Figure 2 Site Plan

1.0 Introduction

A Screening Ecological Risk Assessment (SERA) will be conducted for evaluation of potential adverse environmental effects of site-related constituents of potential concern (COPC) on ecological receptors and resources at or near the Arch Chemicals, Inc. (Arch) facility located in Cheshire, Connecticut (Figure 1). The purpose of the SERA is to provide a conservative evaluation of potential ecological risks posed by site-related COPC as part of the site-wide Resource Conservation and Recovery Act (RCRA) Closure process.

The specific objectives of the SERA will be to:

- Identify potential ecological receptors and habitats and potential migration pathways;
- Identify and evaluate potential ecological risks based on conservative screening of existing soil and groundwater data; and
- Identify COPCs and areas of the Site that might require further evaluation.

The ecological screening assessment will consist of an evaluation of the environmental setting, site history, receptors, and site-specific exposure pathways to species/habitats of concern, and a screening-level evaluation of the exposure and risks using established methods. At the completion of the initial screening procedure, one of the following decisions will be made:

- The preliminary screening is adequate to determine that no substantial ecological risk exists;
- The ecological risk assessment process should be continued to reduce uncertainties in the screening level evaluation; or
- There is substantial potential for ecological risk and no further ecological risk assessment is warranted.

1.1 Site History

The facility at 350 Knotter Drive has been used by Arch/Olin since Olin acquired the facility in 1983. The facility was previously occupied by Siemens, a medical equipment manufacturing company, from its construction in 1975 to 1983. No information was available regarding the specific activities performed by Siemens at the facility. Prior to 1975, the Site and surrounding area was under agricultural use.

The facility was originally constructed in 1975 and was originally serviced by a private septic system. This system was located to the east of the facility building. An addition was built onto the southwestern portion of the building during 1980 and 1981 and the facility was connected to the municipal sanitary sewer system in 1981. The facility is serviced by public water, sanitary sewer, electric and natural gas utilities.

Arch/Olin has used the facility as a research and development (R&D) laboratory facility throughout their occupation of the Site. R&D work conducted by Arch/Olin concentrated on swimming pool chemicals, surfactants, liquid toners, urethane compounds, and biocide compounds. Project-specific specialty chemicals (e.g., propellants for explosives) have also been the subjects of R&D at the facility.

Previous environmental reports for the Site documented the presence of several historical Site features of potential environmental significance that were not related to Arch/Olin site use (see Section 3.0 of the Verification Report (ENSR, 2004a) for a summary of previous Site investigations). These include a "test well" and former treatment pits located within the eastern end of the building as well as a leaching pit and a 1,500-gallon underground storage tank (UST) of unknown use located to the east of the building. These features were never used by Arch/Olin and their function is unknown; however, the 1,500-gallon UST was closed in place by Olin in 1983 after it was emptied and cleaned. The contents of the UST were characterized as an

ignitable organic and were consequently disposed of as hazardous waste. The 1,500-gallon UST and the leaching pit were both located in the vicinity of the facility's interim waste storage (IWS) unit, although they are not associated with it in any way.

The facility boilers are fueled by both fuel oil and natural gas. One 20,000-gallon UST containing #2 fuel oil is located east of the site building, near the boiler room. This fuel oil UST was installed in 1993 as a replacement for a similarly sized tank that was installed in 1975. Previous reports (ENSR, 2004a) indicated no evidence of spills or stains on the ground surface near the UST fill pipe. Additionally, the UST is equipped with an overspill bucket. According to GZA Geoenvironmental, Inc. (GZA), "light contamination" was encountered during the removal of the older fuel oil UST in 1993, and was cleaned up at that time.

Wastewater from the R&D laboratories is discharged to the sanitary sewer pursuant to a permit. A 10,000-gallon underground diversion tank formerly associated with the lab wastewater discharge is present outside the southeastern side of the building. This tank was disconnected from the sanitary sewer line as part of the facility renovation conducted in 2000. Thus, the diversion tank is no longer subject to the potential for receipt of wastewater. Prior to 2000, in the event of a spill, wastewater could be diverted to the tank to prevent discharge to the sanitary sewer. Arch personnel indicated that there was never a need to use this tank.

Chemical wastes from the R&D laboratories are consolidated into 5 to 55-gallon drums and shipped off-site as hazardous waste. The amount generated by any one lab is small; however, the combined volume of waste produced by the formerly more than eighty on-site R&D laboratories rendered Arch a large quantity generator. Arch formerly operated an interim status hazardous waste storage area located in a small building outside the eastern side of the main building. This unit is no longer in use and a Closure Plan Parts 1 to 3 were submitted to the Connecticut Department of Environmental Protection (CT DEP) pursuant to RCRA guidance. The result of these submittals was that the IWS achieved clean closure in 2005. A virgin chemical storage room was also located in the southern side of the building. Arch has no record of a spill from this room.

As part of the Site redevelopment, a new <90-day waste storage area was constructed on the west side of the site building and was used by Arch beginning in January 2001. All wastes currently generated on-site are stored in the new <90-day storage area. This entire room is constructed to function as secondary containment. In addition, containment pans are present beneath the drums and containers in the room. An additional secondary containment device used for catching any spills while pouring contents of small containers into larger containers is located in the <90-day storage area. Bulk storage of virgin chemicals is also located in the new less than <90-day storage area. Bench top quantities are used and stored in the laboratories. No staining, cracks or leaks were observed in the <90-day storage area during an inspection conducted by ENSR in 2003 (ENSR, 2004a).

A grassy area located to the south of the facility was formerly used as a test area for swimming pool chemicals. The test area consisted of several above ground swimming pools. According to Arch personnel, the pools were used as part of the testing procedure to provide normal biological loading to the water.

GZA reported that chiller condensate and non-contact cooling water were formerly directed to a floor drain in the mechanical room. This drain was believed to be connected to the sanitary sewer system however, it was not. Consequently, from 1984 to 1988, this water was discharged to a drainage ditch located to the southeast of the facility. Approximately 4,000-gallons per day for approximately 150 days per year were discharged. The water was reported to contain zinc at a concentration of 0.5 mg/L, chlorine, and phosphonate. Floor drains in laboratory areas were sealed when Olin purchased the facility in 1983.

In 2000, Alexion, a biopharmaceutical company, moved its corporate headquarters to the portion of the building vacated by Arch. Alexion does not conduct manufacturing at the facility; however, part of the Alexion headquarters is used for R&D laboratories. As a result, Alexion maintains status as a conditionally exempt small quantity generator indicating that they generate less than or equal to 100 kg of hazardous waste per month, accumulate no more than 1000 kg on site at any one time and no more than 100 kg of waste, soil,

debris or residue that contains no more than 1 kg of "acute hazardous waste". Alexion waste consists primarily of small quantities of spent organic solvent associated with high-pressure liquid chromatography (HPLC), flammables (alcohols), some toxic compounds and used oil associated with vacuum pump operations. The used oil is not considered a hazardous waste. Alexion's waste storage room is located adjacent to Arch's former <90-day water storage room (Figure 2). Acid and base wastes are neutralized and discharged under BMP to the sanitary sewer.

During their tenancy at the building, Alexion has not had a reportable spill of any virgin or waste chemicals. However, one event occurred in February 2001 when a chemical was noted within the pH adjustment system. During this event, the sump overflowed and a turpentine-like odor was observed. Alexion notified the Connecticut Department of Environmental Protection (CTDEP); however, sample analysis proved that the material on the water that overflowed the sump was turpentine used in cleaning and the event was not considered a chemical spill because it was contained within the pH adjustment system. In addition, the overflow was confined to the system's secondary containment and nothing was released to the environment.

A site wide evaluation the facility was required under the Connecticut Transfer Act when the facility was divested from Olin Chemical to Arch Chemical in February of 1999 and a second Transfer Act requirement was triggered when the facility was sold to Winstanley Enterprises (Winstanley) on July 21, 2000. The Transfer Act assessment involved the collection of soil and groundwater samples from areas of concern (AOCs) located throughout the site to evaluate whether the site was in compliance with the Connecticut Remediation Standard Regulation (RSR) or if remediation to achieve RSR compliance would be required. The investigations completed indicated that the site met all applicable RSR soil and groundwater criteria and no remediation was necessary. On March 30, 2004, ENSR submitted a Verification Report to the CTDEP to bring the investigation and demonstration of compliance with the Connecticut RSR of the facility to regulatory closure. The Verification Report was audited by CTDEP and on August 16, 2004 CTDEP issued a letter indicating that the Verification was acceptable.

1.2 SERA Approach and Methodology

Conducting a SERA is consistent with a tiered approach to ecological risk assessment appropriate for RCRA sites. Conducting assessments in a tiered, step-wise manner allows the risk assessor and risk manager to maximize the use of available site information and sampling data, while providing the opportunity to reduce the uncertainties inherent in the ecological risk assessment process through the use of focused supplemental data collection to fill key data gaps identified in the previous tier of the assessment, if necessary. A SERA is considered the first tier of the ecological risk process. If the results of the SERA indicate sufficient potential ecological risk, further ecological risk assessment may be warranted.

The SERA for the Site will be conducted following the general approach and methodology provided by the U.S. EPA's Framework for Ecological Risk Assessment (U.S. EPA, 1992), Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessment, Interim Final. (U.S. EPA, 1997), Guidelines for Ecological Risk Assessment (U.S. EPA, 1998), and The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments (U.S. EPA, 2001a).

1.3 Organization of the SERA

The SERA will be organized into the three following major sections suggested by EPA's Framework for Ecological Risk Assessment (U.S. EPA, 1992); these sections are Problem Formulation, Risk Analysis, and Risk Characterization. A brief description of the content and purpose of these sections are given below.

- Problem Formulation - In this phase, the objectives of the ERA are defined, and a plan for characterizing and analyzing risks is determined. Available information regarding stressors and specific sites is integrated. Products generated through problem formulation include assessment endpoints and conceptual site models.

- Risk Analysis - Risk analysis is directed by the problem formulation. During this phase of work, data are evaluated to characterize potential ecological exposures and effects.
- Risk Characterization - During risk characterization, exposure and stressor response profiles are integrated through risk estimation. Risk characterization also includes a summary of uncertainties, strengths, and weaknesses associated with the risk assessment.

The risk assessment process is frequently iterative, and new information brought forth during the risk characterization phase, for instance, may lead to a review of the problem formulation phase, or additional data collection and analysis.

The remainder of this SERA work plan is organized in the following manner: Problem Formulation (Section 2.0), Risk Analysis (Section 3.0), Risk Characterization (Section 4.0), and References (Section 5.0).

2.0 Problem Formulation

Problem formulation is the initial systematic planning phase of the ecological risk assessment process. It provides the basis for the approach and methodology to be used as well as defining the specific scope and objectives of the risk evaluation.

The problem formulation phase of the SERA will include the following:

- definition of risk assessment objectives;
- site characterization and definition of the geographic area to be considered;
- selection of specific ecological receptors and exposure pathways;
- selection of assessment and measurement endpoints;
- selection of COPC; and
- development of the conceptual site model (CSM).

2.1 Definition of Risk Assessment Objectives

The purpose of the risk assessment is to evaluate the extent to which compounds present at or released from the property may pose a threat to the environment.

2.2 Site Characterization and Definition of the Geographic Area to be Considered

The site characterization provides details regarding the Site. As described in Section 1.1, the facility was originally constructed in 1975, occupied by Siemens, a medical equipment manufacturing company, from its construction in 1975 to 1983, and acquired by Arch/Olin in 1983. Prior to 1975, the Site and surrounding area was under agricultural use.

The Arch facility is located in the Cheshire Industrial Park in Cheshire, Connecticut (Figure 1). Pertinent site features are illustrated on the Site Plan (Figure 2). The facility is bordered on three sides by other industrial/commercial properties within the Cheshire Industrial Park and Knotter Drive. These properties include Louis Deberadinis/Allied Signal Aerospace Company, FIP Realty Corporation, Federated Corporate Services, and United Technologies Corporation. The Site encompasses approximately 75 acres and is occupied by a 144,700 square foot building. The majority of the building is one story in height with small two story sections and is constructed of concrete block on a slab foundation. Approximately 45 acres is occupied by the building footprint, lawns, parking lot and service roads. The balance of the property, approximately 30 acres, is occupied by undeveloped wetlands, ponds, and wooded areas.

The Site is located in an area where groundwater is classified as GB, indicating that it is considered degraded and is not suitable for human consumption without treatment.

On March 29, 2007, an ENSR ecologist (Dr. David Mitchell) visited the Arch Chemical facility to conduct a qualitative habitat characterization, identify the on-site ecological habitats and potential receptors, and conduct a qualitative reconnaissance of the adjacent water bodies. This information was used to refine understanding of the Site and to identify whether complete exposure pathways potentially existed. At the time of the visit there was some soil disturbance that appeared to be linked to a facility construction project that was underway at the time; however, there is no field evidence of active erosion, stormwater, or groundwater-related releases to off-site areas.

Potential ecological habitats located at or adjacent to the Arch Chemical property include: (1) maintained lawn areas, (2) adjacent upland wooded areas, (3) the Ten Mile River corridor, and (4) two large man-made

impoundments. The surrounding ecological habitats appear to be in good condition and providing appropriate ecological functions. Further information on the ecological habitats and associated receptors are described below.

2.2.1 Maintained Lawn Areas

Much of the developed area in the front (west) of the facility consists of open lawn areas consisting of maintained grass interspersed with trees. This area provides minimal habitat for foraging birds and small mammals and is regularly disturbed. There were considerable number (120+) of Canada geese seen cropping the lawn areas, both on the Arch Chemical property and also on similar lawn areas on adjacent industrial/commercial facilities. Copious amount of goose feces on the soil indicates that these birds have a permanent (i.e., over-wintering) population. Foraging robins were also observed on the lawn areas.

At the rear of the facility, a large pile of dirt was stockpiled to the south of the facility and erosion controls (silt fences) were installed. As noted above, this stockpiled soil appeared to be part of a facility construction project that was underway at the time. Along the east side of the facility, just within the "treeline" of vegetated area, a small, approximately 20 x 20 ft area of earth was disturbed near a sewer manhole. However, there was no evidence of soils or runoff from the Site getting into the habitats of interest.

2.2.2 Upland Wooded Areas

On three sides of the facility, the open lawn areas are bordered by thickets and woods. On the north side of the property, this vegetation is confined to an approximate 100 ft wide wooded riparian corridor through which a 7-ft wide man-made channel (drainage from man-made impoundment located in north-northwest corner) flows. The riparian strip acts as a narrow buffer between Arch Chemical property and the industrial property to the north. There is a natural gas pipeline right-of-way (ROW) which angles across the top section of the Arch property. This ROW includes both open lawn areas as well as an open grassed corridor where tree growth has been actively suppressed.

On the south side of the lawn and building footprint, the property are undeveloped shrub thickets grading to saplings and then mature forest. The shrub coverage is not extensive. The shrub areas provide good habitat as they interface between lawn and forest areas. A cottontail rabbit was observed during the March 29, 2007 site visit, as was deer scat and small mammal burrows. Crow, cardinal, robin, and blue jay were identified by sight or call.

On the east side of the facility there is mature forest that extends to the Ten Mile River, which is located less than a quarter mile east of the facility building. These areas include uplands (including a nice beech stand), wetlands, and several vernal pools. These areas are expected to have typically forest birds and mammals and support amphibian life. Evidence of deer browse (i.e., cropped branches) was observed on small saplings and shrubs.

2.2.3 Ten Mile River Corridor

The local watershed drainage, including outflow from the two impoundments, goes to the east toward the Ten Mile River. This waterbody flows in a northeasterly direction until it confluences with the Quinnipiac River in Southington, CT. Near the Arch property, the river is approximately 20 feet wide and appeared to be 2-3 feet deep. There is a distinct floodplain associated with the river, as marked by elevation and the presence of wetland shrubs. The water was clear and flowing and generally free of suspended material. The substrate appears largely sandy and a non-hard substrate. Overhanging vegetation and backwater areas offer potential for fish foraging and refuge. It is not known if there is a coldwater fishery present. Great blue heron tracks were observed on the streambank indicating that this river supports piscivorous wildlife, such as kingfisher, mink, and others.

2.2.4 Impoundments

Two man-made impoundments are located on the Arch Chemical property. One detention basin, approximately 2 acres, is located in the northwestern corner of the Site. The major inlet for this pond is located at the western end and there was flow from a channel crossing Knotter Drive, where some wetland areas exist. Additional water comes from stormwater inlets or as unorganized overland seepage from adjacent lawn areas. There is no defined outlet structure and the water flows over shallow rocky substrate into the man-made drainage noted above. The shoreline is open and grassed to the waterline for about 2/3 of the periphery. This shoreline was fenced and signage indicated that this was a "Goose Population Control Area" – prohibiting feeding of the geese. The outlet area to the east is wooded and there were shrubs and grass near the major inlet. There were six ducks and two geese on the pond, with many other geese observed cropping lawn on next property. It was presumed that the pond maintained a fish population although none were directly observed.

The second impoundment is located in the south of the Arch Property in the drainage from wetland areas located near the gas pipeline ROW and then going southeast towards the Ten Mile River. A man-made impoundment created by an earthen berm approximately 5 feet wide is located in the southeastern portion of the property. The earthen berm nearest the river is breached and water flows freely out approximately 200 feet into a loop of the Ten Mile River. The western end of the basin has filled in with a *Phragmites* monoculture. The open water area was estimated at approximately 3 acres and appears very shallow. The observable substrate was clayey with much leafy organic material and the water leaving the pond somewhat turbid. Approximately 12 ducks were on the pond during the site visit.

2.3 Selection of Specific Ecological Receptors and Exposure Pathways

Ecological receptors are the components of ecosystems (i.e., species or sensitive habitats) that are or may be adversely affected by a chemical, physical, or biological stressor. Receptors can be any part of an ecological system, including species, populations, communities, and the ecosystem itself. The SERA will focus on the pathways for which (1) chemical exposures are the highest and most likely to occur, and (2) there are adequate data pertaining to the receptors, exposure pathways, and toxicity for completion of risk analyses.

Potentially complete exposure pathways for ecological receptors were identified through relevant site documents and the site visit. The primary exposure pathways evaluated in the SERA will be the direct exposure of terrestrial receptors to surface soils and direct exposure of aquatic receptors to surface water. The existing soil data will be evaluated within the SERA even though it generally represents deeper soils than ecological receptors are expected to encounter (i.e., 0 to 6 inches). Due to a lack of surface water data, a dilution attenuation factor (DAF) will be applied to the groundwater data to represent surface water concentrations.

Previous investigations completed at the Site did not identify a mobile plume that could impact surface water (ENSR, 2004a) so this groundwater evaluation is very conservative. Previous reports compared the groundwater data against the RSR Surface Water Protection Criteria (SWPC), which are criteria intended to protect the quality of a surface water body, wetland area, or intermittent stream to which a groundwater plume discharges (if present).

2.3.1 Threatened/Endangered Species and Species of Special Concern

The potential presence of threatened/endangered species or species of special concern in the Site vicinity will be assessed. The CTDEP's State and Federal Listed Species and Significant Natural Communities Map for the town of Cheshire has been reviewed. A request for review was submitted to the Connecticut Natural Diversity Data Base (NDDDB) on March 9, 2007 because the Site appears to be within ½ mile upstream of an NDDDB Area of Concern. The results of the NDDDB review will be incorporated into the SERA.

2.4 Selection of Assessment and Measurement Endpoints

According to the U.S. EPA (1998), assessment endpoints are formal expressions of the actual environmental value to be protected. They usually describe potential adverse effects to long-term persistence, abundance, or reproduction of populations of key species or key habitats. Measurement endpoints are the physical, chemical, or biological aspects of the ecological system that are measured to approximate or representative assessment endpoints. Measurement endpoints are often stressor-specific and are used to evaluate the assessment endpoint with respect to potential ecological risks. The endpoints are presented below.

Assessment Endpoint 1: The assessment endpoint is the sustainability of terrestrial invertebrate and plant communities in the vicinity of the Site typical of comparable Connecticut upland areas.

- **Measurement Endpoint 1-1:** Comparison of soil analytical chemistry results to ecological soil screening values. Concentrations in excess of ecological soil screening values will be considered indicative of a potential for ecological risks.

Assessment Endpoint 2: The assessment endpoint is the sustainability of aquatic invertebrate, fish, and plant communities in aquatic habitats in the vicinity of the Site typical of comparable Connecticut aquatic habitats with similar morphology and hydrology.

- **Measurement Endpoint 2-1:** Comparison of groundwater analytical chemistry results to surface water screening values for the protection of aquatic life. To account for the fact that aquatic receptors are not directly exposed to groundwater, a DAF will be applied. Concentrations of groundwater, with the DAF applied, in excess of surface water screening values will be considered indicative of a potential for ecological risks.

Although ecological food chains clearly exist in the vicinity of the Site, the groundwater and soil to be evaluated in the SERA generally lack elevated concentrations of bioaccumulative compounds. In addition, wildlife receptors are not likely to be exposed to groundwater or deeper soils where releases may have occurred. Therefore, vertebrate wildlife food chain exposure pathways are not believed to represent a significant potentially complete ecological exposure pathway, and are not proposed for further SERA evaluation. The majority of chemical stressors are inorganic constituents or volatile compounds presumed to be related to former operations at the Site. The primary potential effects associated with exposure to these COPCs at the Site are related to direct toxicity, rather than indirect (e.g., food chain) effects.

2.5 Selection of COPCs

COPCs represent the constituents detected in the environmental media that could present a potential risk for ecological receptors. Constituents with maximum concentrations less than their respective constituent-specific risk-based screening value will not be retained as COPCs; constituents with maximum concentrations in excess of the screening values will be retained as COPCs. If no screening value is available, the constituent will be selected as a COPC. Constituents that were not detected will not be evaluated. The SERA will evaluate the results of previous soil and groundwater sampling efforts to evaluate potential risks to ecological receptors. The available data was generally collected during previous investigation efforts conducted by ENSR and GZA and focused on soil from borings and groundwater collected from monitoring wells. The following reports were reviewed for relevant existing soil and groundwater data:

- Verification report (ENSR 2004a); and
- Dieldrin Investigation Summary Letter (ENSR 2004b)

2.6 Conceptual Site Model

The end product of the problem formulation step will be the development of a CSM. The CSM for the Site will summarize the current knowledge of the Site and ecological resources potentially at risk. The CSM is a set of working hypotheses regarding how ecological receptors at the Site may be exposed to contaminants. The

CSM for the Site will help to describe the origin, fate, transport, exposure pathways, and receptors of concern. The objectives of the CSM will be to identify the ecologically important exposure and migration pathways, and to specify exposure scenarios that will be evaluated in the ERA.

3.0 Risk Analysis

The risk analysis phase of the SERA is based on the CSM developed in problem formulation. Risk analysis includes the characterization of potential ecological exposure and corresponding effects. The ecological exposure assessment involves the identification of potential exposure pathways and an evaluation of the magnitude of exposure of identified ecological receptors. The ecological effects evaluation describes the potential adverse effects to ecological receptors from exposure to COPC in environmental media. Potential adverse ecological effects for benthic receptors were evaluated based on comparisons against literature derived screening values.

3.1 Terrestrial Receptor Risk Analysis

Terrestrial invertebrate and plant communities in the upland portions of the Site may potentially be exposed to COPCs from direct contact with soil. To assess potential risks to these receptors, measurement endpoints include evaluation of available analytical chemistry data and comparison to screening benchmarks.

3.1.1 Soil Benchmark Screening

Soil analytical chemistry analysis results from each of the sampling stations will be compared to risk-based screening values. Sources for soil screening values will be considered in this order:

- Ecological Soil Screening Levels (Eco-SSLs) developed according to U.S. EPA guidance (U.S. EPA, 2005);
- U.S. EPA Region 4 soil screening levels (U.S. EPA, 2001b); and
- U.S. EPA Region 5 Ecological Screening Levels (ESLs) for soil (U.S. EPA, 2003).

These ecological screening values are based on conservative endpoints and sensitive ecological effects data. They represent a preliminary screening of Site contaminant levels to determine if there is a need to conduct further investigations at the Site. However, these ecological screening values should not be used as remediation levels. Constituents will be retained for further consideration as COPCs if the maximum detected concentration exceeds the ecological screening values, or if no screening values are identified.

3.2 Aquatic Receptor Risk Analysis

Aquatic invertebrate, fish, and plant communities in the wetland portions of the Site may potentially be exposed to COPCs from direct contact with surface water. To assess potential risks to these receptors, measurement endpoints include evaluation of available analytical chemistry data and comparison to screening benchmarks.

3.2.1 Groundwater Benchmark Screening

Groundwater analytical chemistry analysis results from each of the sampling stations will be compared to risk-based surface water screening values. Prior to the screening a DAF will be applied to account for the reduction in constituents between the groundwater source and discharge to a surface water body.

Sources for surface water screening values will be considered in this order:

- Connecticut Water Quality Standards for aquatic life (CTDEP, 2002);
- Federal Ambient Water Quality Criteria for aquatic life (U.S. EPA, 2006); and
- Secondary Chronic Values developed by Oak Ridge National Laboratories (Suter and Tsao, 1996).

These ecological screening values are based on conservative endpoints and sensitive ecological effects data. They represent a preliminary screening of Site contaminant levels to determine if there is a need to conduct further investigations at the Site. However, these ecological screening values should not be used as remediation levels. Constituents will be retained for further consideration as COPCs if the maximum detected concentration exceeds the ecological screening values, or if no screening values are identified.

4.0 Risk Characterization

Risk characterization provides a quantitative evaluation of the potential for adverse ecological impacts due to COPCs in an area of concern. The conclusions regarding overall risk to ecological receptors will be based on a weight-of-evidence approach, which will integrate the results of all components of the assessment methodology (i.e., an approach that integrates results of benchmark screening and field observations to draw risk-based conclusions). The weight-of-evidence components will be designed to provide measures of potential risks for different ecological receptors and exposure pathways, and will provide relative measures of exposure and effects in the Site.

The results of the environmental risk analysis will be analyzed and interpreted to determine the likelihood of adverse environmental effects, and to determine whether a conclusion of no significant risk can be reached for each assessment endpoint evaluated. The ecological risk characterization will summarize the results of the risk analysis phase of work and will provide interpretation of the ecological significance findings. Aspects of ecological significance that will be considered to help place the sites into a broader ecological context include the nature and magnitude of effects, the spatial and temporal patterns of effects, and the potential for recovery once a stressor has been removed.

5.0 References

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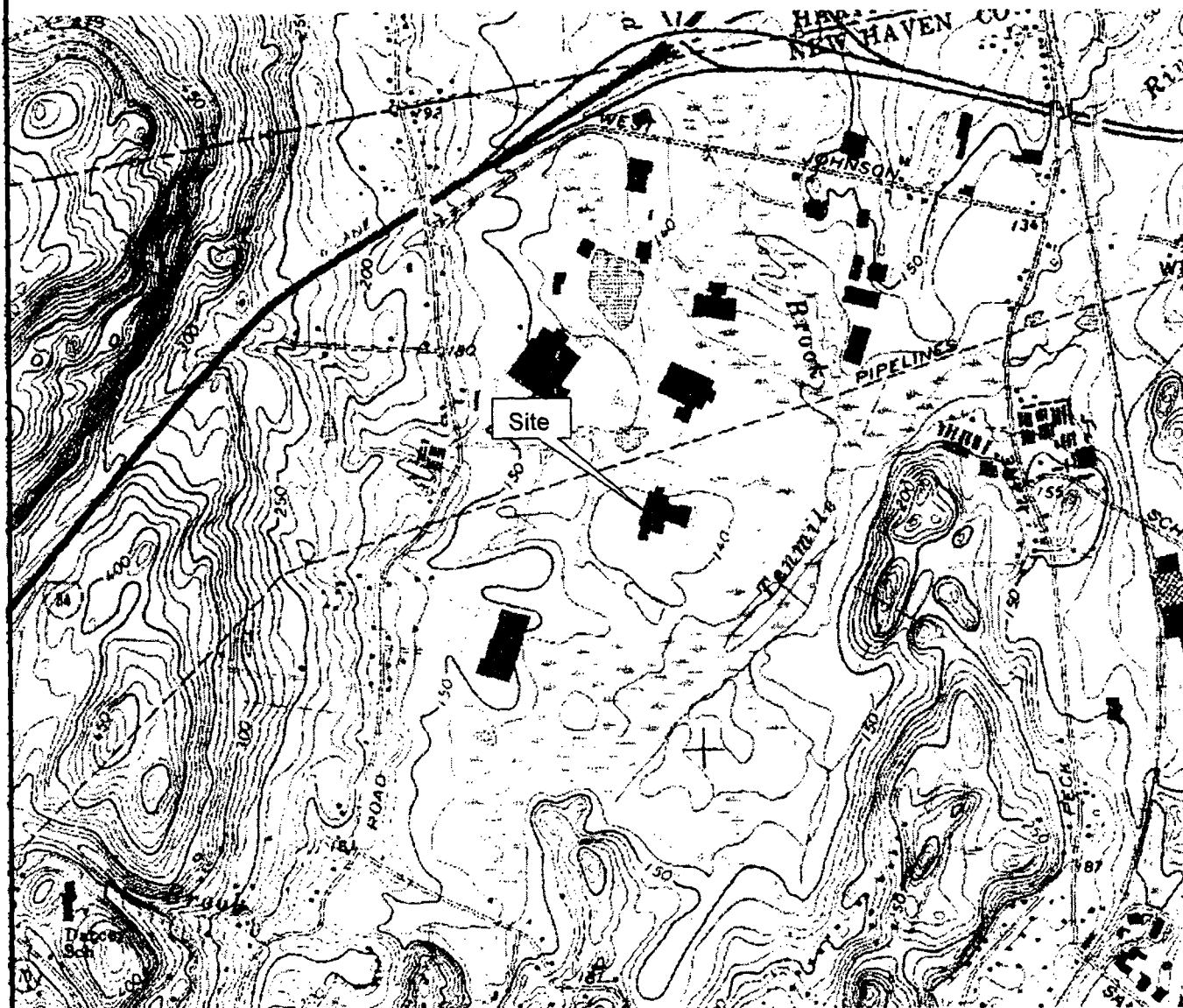
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FIGURES



Arch Chemical, Inc.
350 Knotter Drive
Cheshire, Connecticut

Site Locus

Arch Chemical, Inc.
 350 Knotter Drive
 Cheshire, Connecticut

FIGURE 1

ENSR | AECOM

April 2007

00489-014

LEGEND:

- Approximate Property Boundary
- GZ-9 Monitoring Well/Soil Boring with Well Head Elevation (installed by GZA, 1999)
- GP-1 Geoprobe Location
- HW-1 Monitoring Well/Soil Boring with Well Head Elevation (installed by ENSR, 2001)
- HA-1 Shallow Hand Auger Sample

CLIENT

Arch Chemicals, Inc.
1200 River Road
Charleston, Tennessee 37310

PROJECT TITLE

Arch Chemicals, Inc.
350 Knottter Drive
Cheshire, Connecticut

FIGURE TITLE

Site Plan

APPROVED BY

REVIEWED BY

DRAWN BY

G. Moquin

SCALE

1" = 200'

JOB NUMBER

0489-004

DATE

February 2004

ENSR

2 Technology Park
Westford, Massachusetts
(978) 589-3000

Figure 2

SHEET

ENSR

